SEP 27 1926

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Chicago, August 21, 1926 (Issued Every Other Week) Volume XXIX, No. 17

Nuttall-Timken

NUTTALL, one of the world's largest makers of gears, mounts them on Timken Tapered Roller Bearings, in a whole line of Nuttall gear drives.

An impressive combination of industrial experience is represented in products sponsored by two such institutions as Nuttall and Timken.

Nuttall, with its rigid standards, honors Timken by concurring in the basic Timken advantages—reduced friction to save power, lubricant and belts—tapered design to carry thrust without complication or loss of anti-friction properties—Timken-made steel to assure material as fine as possible for its purpose—and Timken *POSITIVE ROLL ALIGNMENT* for speed characteristics and elimination of the bearing cage as a calculable factor.

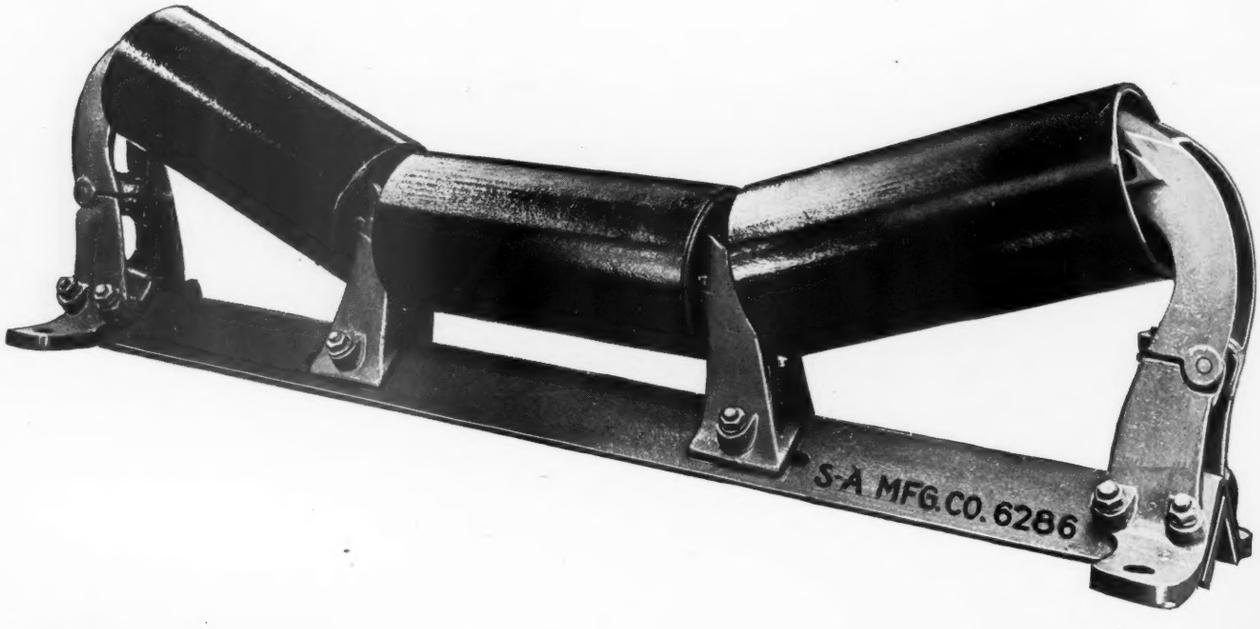
THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN Tapered Roller BEARINGS

MEMBER A. B. C. *The Only Paid Circulation covering the Rock Products Industry* MEMBER A. B. P.

Printing of This Issue Is 5200 Copies. Next Issue Will Be September 4

SACON CARRIER



Every big belt conveyor deserves a good carrier. The economic operation largely depends on this item of equipment. The smooth, easy-turning rolls on the high grade ball bearings reduce the ultimate horse power required to operate the belt.

Your Conveyor Deserves Sacon Carriers

STEPHENS-ADAMSON MFG. CO., AURORA ILLINOIS

PACIFIC FACTORY
LOS ANGELES

BRANCHES IN
PRINCIPAL CITIES

STEPHENS-ADAMSON

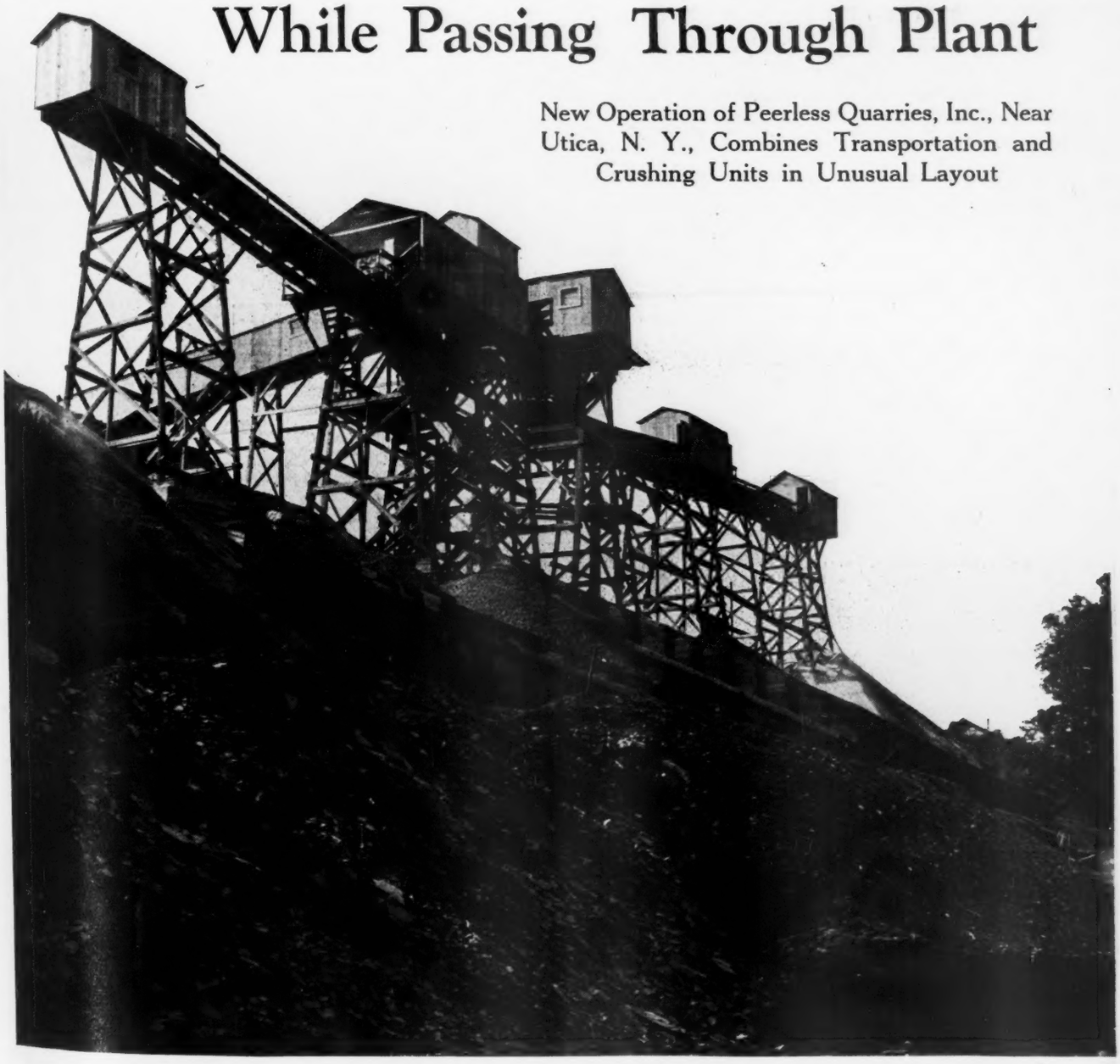
When writing advertisers, please mention ROCK PRODUCTS

Rock Products
CEMENT and ENGINEERING NEWS

Volume XXIX | Chicago, August 21, 1926 | Number 17

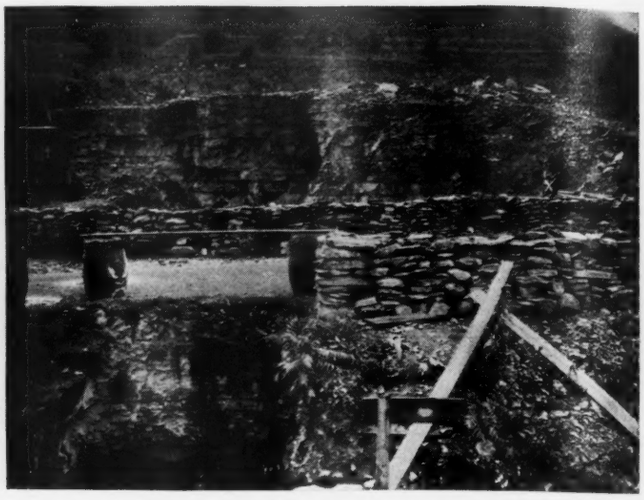
Material Advances Toward Loading Point While Passing Through Plant

New Operation of Peerless Quarries, Inc., Near Utica, N. Y., Combines Transportation and Crushing Units in Unusual Layout



Secondary screening and sizing plant above ground bins from which stone is recovered through a tunnel

Tunnel under road to allow shovel to pass



Old country road that had to be saved

THE Peerless Quarries, Inc., of Utica, N. Y., operates a quarry near Oriskany Falls, about 17 miles from Utica. The quarry was originally opened for building stone and has been operated for almost a century, producing not only building stone but crushed stone and in earlier times kiln stone for burning to lime. The rock is a fairly pure calcium limestone containing from 1 to 2% of magnesia and a little silica. It is crushed to commercial sizes and, although the quarry is free from clay seams, all the product except the screenings is washed before being loaded.

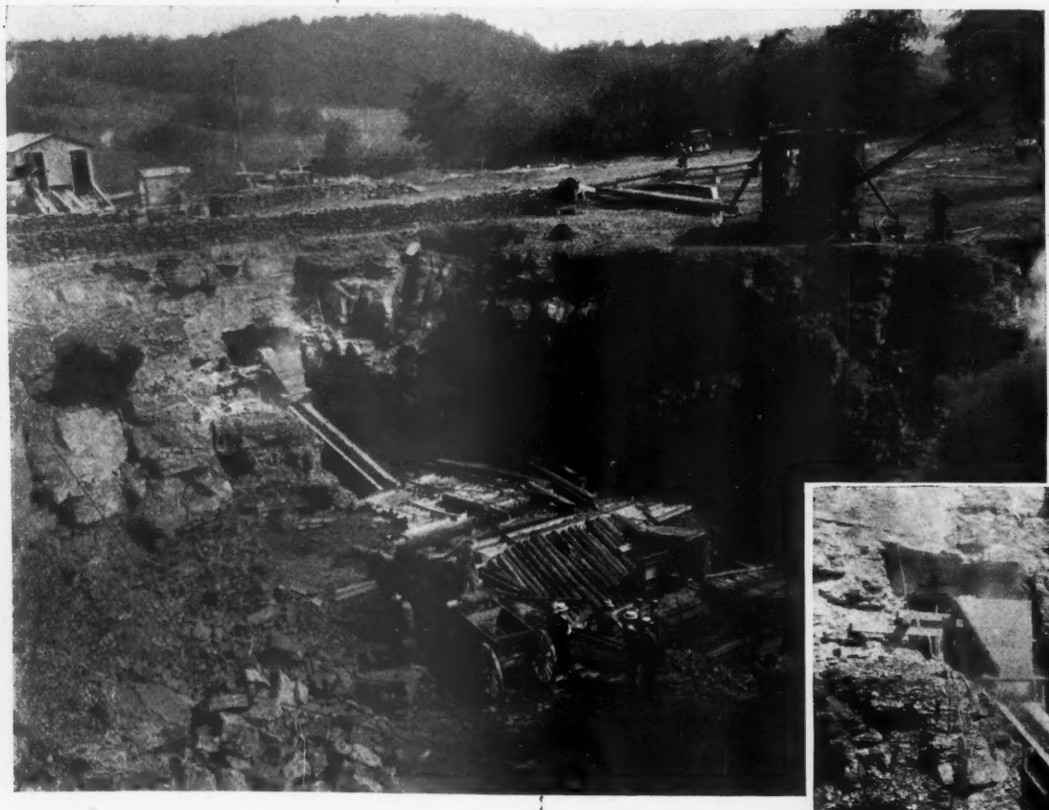
Engineering Practice Applied to Unusual Problems

This operation is of unusual interest because it is an example of sound engineering practice applied to the solution of some unusual and difficult problems. The members of the company are almost all engineers and it was not necessary to go outside the organization to secure either the layout or the details of the design. H. R. Beebe is president and H. V. Owens is vice president; A. S. Owens, secretary-treasurer. S. P. Van Hyming is quarry superintendent and Latham Gray is plant superintendent.

The Stephens-Adamson Co., which furnished the conveyors, did the special engineering work required in connection with the conveying equipment.

New Quarry Opened in Floor of Old Quarry

The original quarry face is 40 ft. high. The old floor of this quarry could almost be used as a dance floor, it is so smooth and level. This 40-ft. face was worked back into the hill for many years, and before the property was acquired by the present owners. As the face receded the overburden to be removed and the distance which the rock had to be transported to the crusher both increased. Because there was a good



Looking down at crusher pit in new quarry, with enlarged detail view at left. It was decided to go below the previous floor rather than to further extend the old face

Carefully arranged system of conveyors delivers the various sizes of material to ground bins

depth of stone of the same quality below the old quarry floor it was judged better to go down rather than farther away horizontally in extending operations. In the latter part of last year a new quarry was opened in the floor of the old quarry and arrangements were made for building a new crushing plant. This was completed and put in service in June, 1926.

Highways on Two Levels and Other Difficulties

The ground presented an unusual number of difficulties. The railroad track on which cars were to be loaded lay at the bottom of a hill 364 ft. from the point where the primary crusher was to be set, and 89 ft. below the original quarry floor level. At this level was an old county road which had to be preserved in opening the new workings. Below this, a distance of 25 ft., lies a new paved state highway which is between the quarry and the railroad track. This highway is on the brow of a hill about 40 ft. above the track level. Hence the flow of the material from the newly opened quarry had to be under the old county highway, by a belt in a tunnel, over the paved highway, by a belt in a structure placed high enough so that it would not interfere with traffic, and then down the hill by gravity to the track level.

In starting operations a crane was brought in at the county road level and by the use of loading skips a hole was excavated 25 ft. deep, to the level of the paved highway. This was widened out and made into the new quarry working. Then a pit 20 ft. 9 in. deep was dug and the primary crusher installed. A drainage tunnel 330 ft. long was driven from this pit through the hill under the state highway to keep the pit free from water. A tunnel was cut through the ridge left under the county road, for a belt to take the material from the primary crusher to the scalping screen of the plant, and a large tunnel was made beside it to serve for bringing in material from the paved highway. This was made wide and high enough so that a newly bought electric shovel could pass. The remaining units of the plant were installed at the level of the paved highway and on the track level and connected by conveyor belts.

Rock Always Moving Toward Loading Point

It will be seen that in this plant the rock continually advances toward the loading point while it is being crushed and sized. This saves both the installation cost and the operating cost of a separate arrangement for transporting the crushed material, although a portion of this saving is used to maintain somewhat longer conveyors and possibly in an increased labor cost due to the widely separated units. A layout of this kind is unusual but not unique. Readers of Rock Products may remember the layout of the New York Trap Rock Corp. plant at the Verplanck quarry of this company described in the Annual Review number for 1925. In this case a similar engineering problem was solved in the same way.

When the Peerless plant started, the new shovel, a Marion No. 37, fed the crusher directly from the new quarry face. In July when the plant was visited, this shovel was feeding to a second (Erie) shovel which fed the crusher. In a short time the face will be sufficiently advanced so that tracks can be laid and the quarry worked in the conventional manner.

Three Crushers in Use

The primary crusher is a Buchanan jaw crusher with 36 x 48-in. opening. This is set to deliver to a Good Roads scalping screen 21 ft. long and 60 in. in diameter by a 36-in. belt of 157 ft. centers. The oversize of this screen goes to three crushers, an Acme jaw with 16 x 32-in. opening, a No. 6 Gates gyratory crusher and an Acme jaw crusher with 12 x 24-in. opening, which was just being installed when the plant was visited. The product of all three crushers

Two scrubbing screens in towers above railroad bins wash the material before delivery

goes to a 24-in. conveyor belt, 61 ft. centers, which returns to the 36-in. belt from the primary crusher and thence to the scalping screen, thus putting the secondary crushers in closed circuit with the screen.

The undersize of the scalping screen, all passing a 2¾-in. round hole, goes by a 24-in. belt conveyor of 138-ft. centers to the main sizing screen. This is 20 ft. long and 51 in. in diameter, of Good Roads make. The main section has 1½-in. holes and the jacket 3/16-in. holes. The screenings which pass the jacket go to an 18-in. conveyor of 102-ft. centers which conveys them to the screenings bin. The oversize, between 2¾-in. and 1½-in. falls directly from the screen to bin for "No. 3" as this size is locally known. The intermediate size (between 1½-in. and 3/16-in.) goes by an 18-in. conveyor of 35-ft. centers to a sizing screen 16 ft. long and 42 in. in diameter which has ¾-in. perforations. The oversize (between 1½-in. and ¾-in.) falls to the "No. 2" bin and the undersize (between ¾-in. and 3/16-in.) goes to the "No. 1" bin. There is another belt, 24 in. wide and 51-ft. centers, for making a mixture of No. 1, No. 2 and No. 3 in a combination bin, to meet the demands of the trade.

The sizing screens and the belts connecting them are on a timber structure 32 ft. high on the other side of the paved highway from the scalping screen. The connection is made by the 138-ft. belt mentioned which is in a covered gallery and supported by a tower on the edge of the highway.

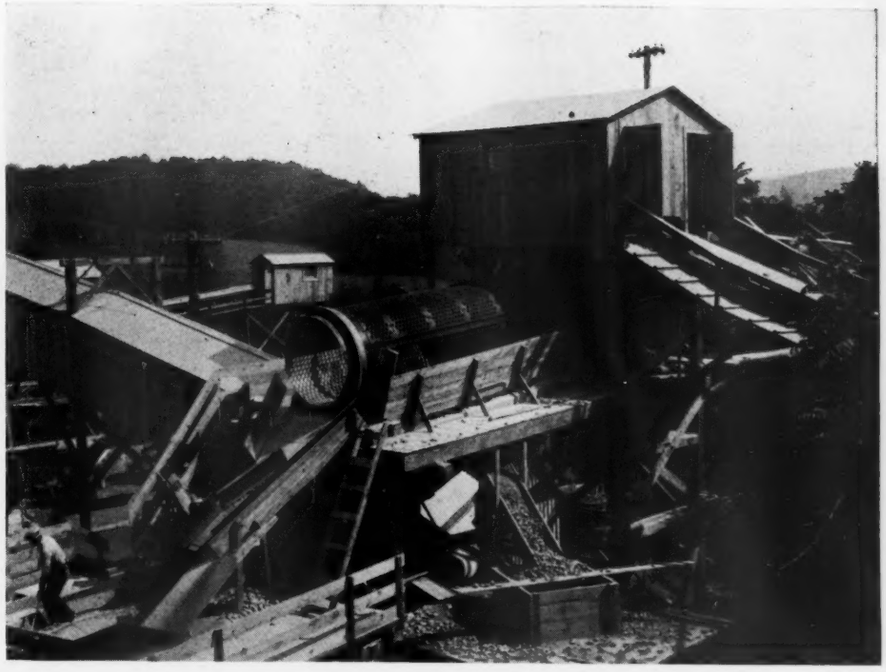
Old quarry face

Present quarry working

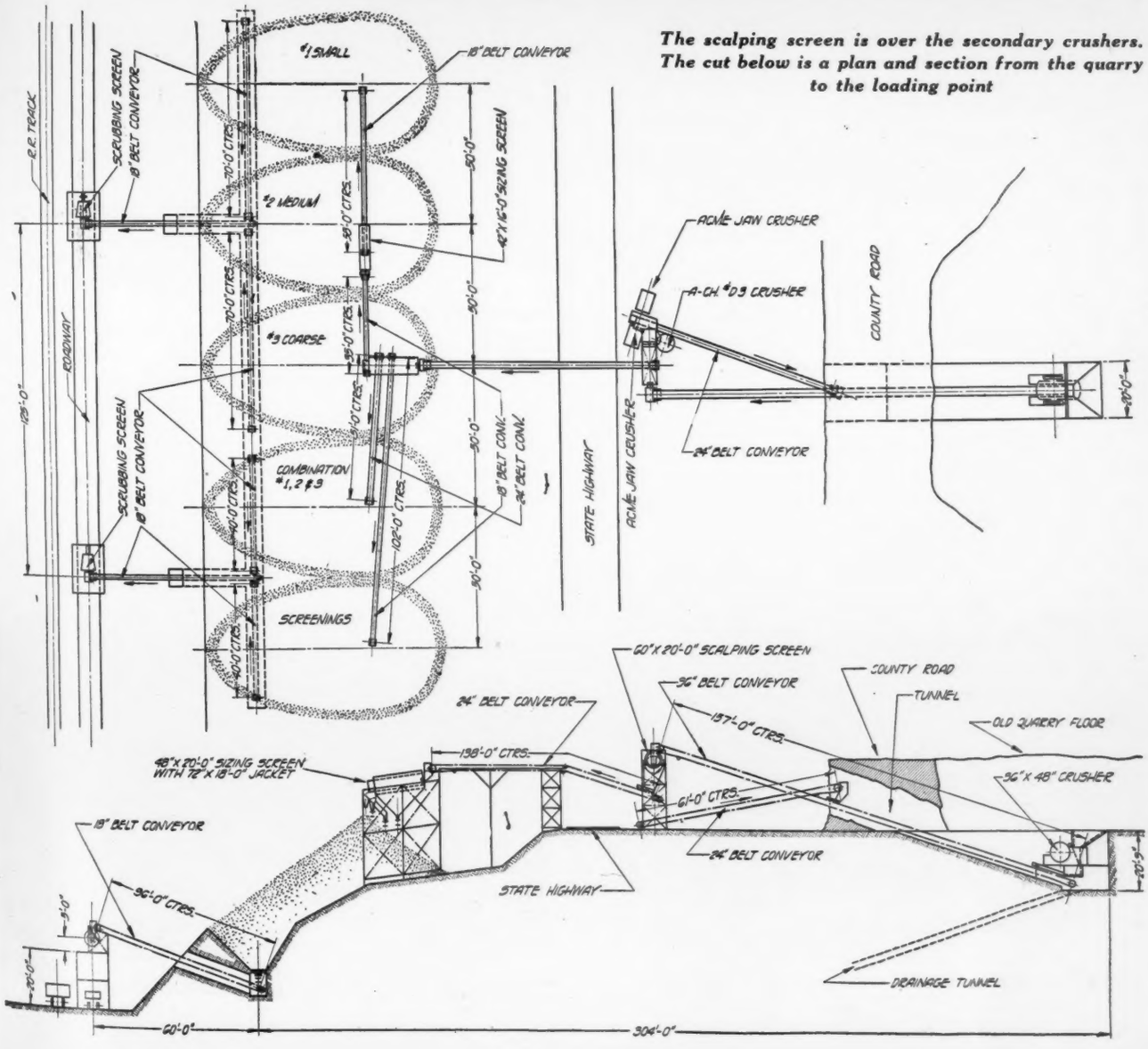
Unusual Bin Construction

The bins below the highway were constructed in an unusual manner. At the bottom of the hill a concrete tunnel 250 ft. long was built. This contains four 18-in. belts, two of 40-ft. centers and two of 70-ft. centers. The dirt and rock above this on the side of the hill were cleared off and thrown up to form an embankment on the other side of the tunnel. This holds the material in the bins from sliding down hill. Several gates in the tunnel permit the bins to be drawn upon so that any product or mixture may be loaded.

The four gathering belts in the tunnel discharge on either or both of two inclined loading belts 18 in. wide and of 96-ft. centers. The lower end of each is in a short cross tunnel; the upper end is on a structure by the side of the railroad. The belts discharge into 48-in. Gilbert scrubbing and washing screens supported on these structures and the stone passes through these and is thoroughly washed before it goes into the loading bins below. Water for washing



The scalping screen is over the secondary crushers. The cut below is a plan and section from the quarry to the loading point



is supplied by two 3-in. Morris pumps. The loading bins are provided with side gates and bottom gates. The side gates are used for loading railway cars and the bottom gates for loading trucks. A considerable part of the product is delivered by truck, for the plant is within truck delivery range of many of the thriving industrial towns which are in this part of New York.

Carefully Chosen Electrical Equipment

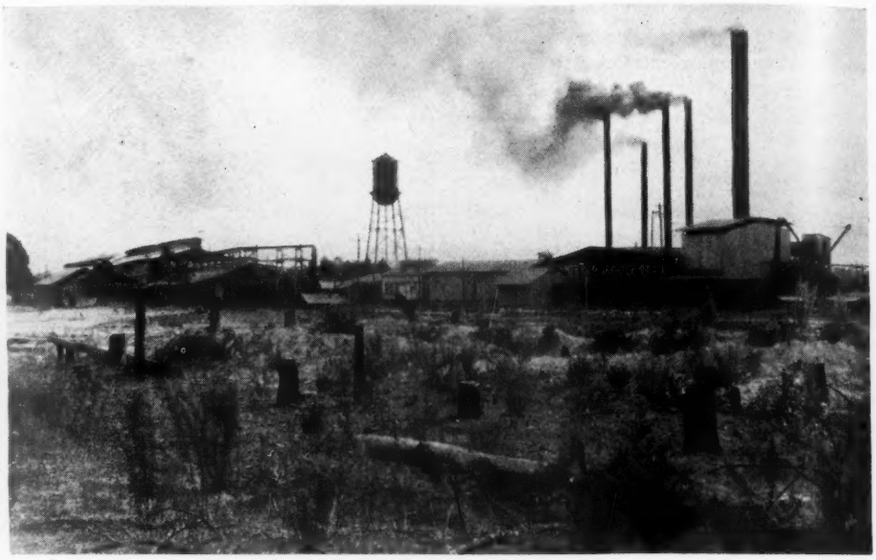
The electrical equipment of this plant has been designed and installed with unusual care. The current comes in to three 200-k.v.a. transformers, 4600 volts on the high side and 440 volts on the low. It goes to two quick-break Trumball switches on the 1200-amp. main distributing panel made by the Crouse-Hinds Co. of Syracuse. From this it goes to a 468-amp. panel and a 257-amp. panel of the same make.

The motors are about equally of General Electric and Westinghouse make. The following gives the sizes used to drive different machines:

Primary jaw crusher, 36x48-in., 125 hp.
Acme secondary crusher, 16x32 in., 75 hp.
Gates gyratory crusher, No. 6, 50 hp.
Acme secondary crusher, 12x24-in., 35 hp.
Conveyor belt, 36-in., 157-ft. centers from primary crusher, 40 hp.
Scalping screen, 20 ft. by 60-in., 15 hp.
Return belt, 36-in., 61-ft. centers, 5 hp.
Belt from scalping screen to sizing screen, 24-in., 138-ft. centers, 7½ hp.
Main sizing screen, 20 ft. by 48-in., 15 hp.
Second sizing screen, 16 ft. by 42 in., 15 hp.
Belt to No. 1 bin, 18 in., 58-ft. centers, 5 hp.
Belt to screenings bin, 18 in., 102 ft. centers, 10 hp.
Belt to combination bin, 18 in. and 51-ft. centers, 5 hp.
Two belts in tunnel each 18 in., 70-ft. centers, each, 10 hp.
Two belts in tunnel, each 18 in., 40-ft. centers, each, 5 hp.
Two belts from tunnel to washing screen, each 18 in., 96-ft. centers, each, 15 hp.
Two 3-in. centrifugal pumps for wash water, each 15 hp.

"Superservice" flexible cable, made by the Rome Wire Co., is used to carry current to the well drill and to the Marion shovel.

The offices of the Peerless Quarries, Inc., are at 404 Court Street, Utica, N. Y.



Plant and drying sheds of Edgar Kaolin Co.

How Kaolin Is Prepared for Use by Florida Producers

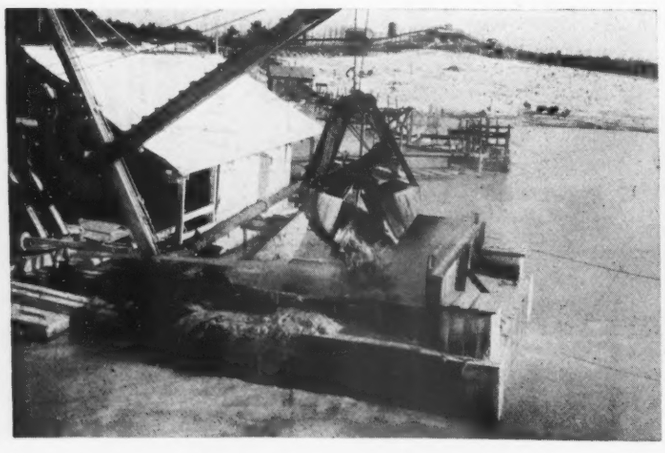
Edgar Plastic Kaolin Co. and Other Concerns Have Plants for This Purpose

By J. R. Thoenen

THE china clays or sedimentary kaolins of Florida have been used for the past 30 years almost exclusively in the whiteware industries for the manufacture of pottery, tile, spark plugs and porcelain for electric fixtures.

Authorities differ as to the exact origin of these clays, but practically all agree that they are sedimentary. This conclusion acknowledges a foreign source and probably water transportation. It is thought by many that they were originally from the residual clays of northern Georgia and South Carolina. In the process of their deposition, however, large quantities of quartz sand with some mica have become intimately mixed with the clay until as found in the beds at Edgar, Fla., and in Lake county the proportion of sand to clay will average about as 65 to 35. The origin of the quartz sand has so far not been satisfactorily worked out, neither has the exact geological age of the deposits been settled. However, the clays are present over considerable areas in central Florida and are favorably known throughout the country in the ceramics industries.

The Edgar Plastic Kaolin Co. began operations at Edgar, Fla., in 1891 and has been operating continuously since that time. The United Clay Co. has recently opened a similar plant in the vicinity and there are two



Dredge dipper and sump at Kaolin plant

Filled settling pond where clay is separated

other producers near Leesburg in Lake county. One of the latter is operated and owned by the Edgar company.

Overburden Removed by Hydraulic and Shovel Methods

As in much of peninsular Florida the ground water level is quite close to the surface, which greatly modifies the methods of mining used in the recovery of the clay sand. Beds range in thickness from 5 to 30 ft. and are covered by from 5 to 20 ft. of yellow sand. This overburden is removed by one of the Lake county operators by hydraulic methods, but the more common method is by steam shovel. At Edgar the sand is loaded by an Erie full revolving, caterpillar traction coal fired steam shovel into small western type side dump narrow gauge cars and hauled by steam dinky locomotives to a nearby lake for disposal.

After removing the overburden a hole is dug in the clay-sand bed and filled with water pumped from the previously mentioned lake. In this artificial pond a clamshell dredge is floated. The 25-ft. stratum of clay-sand is dug by this method where the beds are of large extent. In smaller pits where the dredge cannot operate efficiently centrifugal sand pumps are floated on wooden hulls and the clay and sand pumped from beneath the water surface direct to the separating plant. The dredge dipper discharges its load of sand and clay to a floating hopper covered with a coarse grizzly. Large masses of clay are broken up on this grizzly by a hydraulic monitor and washed down to the suction of another centrifugal pump which elevates the material to the separating plant.

Separating Sand from Clay

The separation of the sand from the clay is accomplished in a series of sand traps built of wood in trough shape and fitted with baffles and agitators. By this means the fine clay is kept in suspension in the conveying water while the sand settles to the bottom and is discharged to waste. The water and suspended clay is then sent to a system of settling ponds and allowed to settle. After the required settling period the wet clay is removed by pumps assisted by drag conveyors in the ponds and forced into filter presses.

Dredge pond and pipe lines at Edgar plant

After removal of the water in the presses the dewatered clay is dropped to cars and loaded by hand to conveyor belts which take it to the drying sheds. The drying sheds are open to the air for the upper part of their sides while the lower portion forms the storage bins for the dried material. Drying is accomplished by laying the pressed slabs of clay on shelves of steam pipes. When dry the clay is simply broken up and allowed to fall to the bins below, from which it is loaded to railway cars from side openings.

Quartz Sand as a By-Product

Owing to the composition of the natural beds there is a large amount of waste material handled in the nature of quartz sand. This is a coarse sharp sand admirably suited for concrete aggregate and concrete products manufacture. Owing to the volumn of water necessary in conveying the clay to the separators and the lack of other deleterious material than the kaolin the resulting tailings are clean and need little preparation for the market as sand. The Leesburg Sand & Supply Co. of Leesburg, Fla., take advantage of this and by arrangement with the Edgar company pump this sand from the tailings dump to railway cars by floating sand pumps and ship it to market. Occasionally the sand requires some further washing, but as a rule it is already for shipment as pumped from the dump.

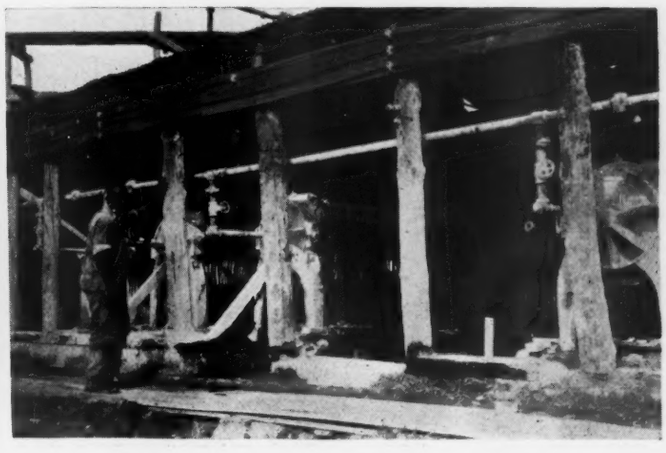
Increased Production of Asbestos in 1925

THE total quantity and value of asbestos mined in the United States and sold in 1925, as reported by producers to the United States Bureau of Mines, amounted to 1,258 short tons, valued at $51,700. These figures comprise 93 tons of chrysotile asbestos, valued at $40,750, mined in Arizona and California, and 1,165 tons of amphibole asbestos, valued at $10,950, mined in Georgia, Idaho and Maryland.

The sales of chrysotile asbestos showed a decrease of 46% in quantity and an increase of 20% in value, compared with 1924, and the sales of amphibole asbestos were more than nine times as great in quantity and were 28% greater in value.

Imports of unmanufactured asbestos for consumption, amounted in 1925 to 230,520 short tons, valued at $7,134,302, and the exports were 1,109 short tons, valued at $70,846. Corresponding figures for 1924 were: imports, 183,250 tons, valued at $5,602,945; exports, 1,270 tons, valued at $93,163.

Removing clay from filter presses



Battery of filter presses

The Design of Stone Crushing Plants

Part IV. Quarry Shovels and Primary Crushers

By Hugo W. Weimer
Consulting Engineer, Milwaukee, Wisconsin

THE preceding articles gave information regarding the various types of crushers, screening equipment, etc., for stone crushing plants, and sufficient data to make an estimate and flow sheet of a small or medium size plant. It will be necessary to discuss the relation of the quarry shovel to the primary crusher, and what type of primary crusher would be most suitable, before we can proceed with a more complicated layout than those described and illustrated in the articles preceding this.

In recent years hand loading in the quarry has been rapidly eliminated by the use of shovels in most operations of any size. The first use of railroad type steam shovels in the quarry was so successful that the designs and sizes of shovels and primary crushers were carefully studied so that these units might work to the best advantage. The result is that both shovels and primary crushers have reached a high state of development at the present time.

Certainly the shovel manufacturers are to be commended for keeping pace with the development of the rock products industry. The first shovel used in the quarry was the railroad type steam shovel illustrated in Fig. 1. At a later date electric power was used in some places, and still later followed the caterpillar mounting for the railroad type. Successful use of shovels was assured even though the railroad type was rather clumsy in operation.

Today we have the very efficient full revolving caterpillar mounted shovels for either steam or electric power as illustrated in Fig. 2.

Modern shovels are built with various sizes of dippers ranging from 1½ cu. yd. to 4 cu. yd. capacity, suitable for stone quarry operation. The size of the dipper is determined by its capacity in cubic yards when level full. The shape of a dipper is very nearly a cube. Thus the cube root of the rated capacity in cubic yards will give the width, length or depth of the inside of same in yards, which multiplied by 36, the number of inches in a yard, will give the dimension in inches. This dimension is then reduced about 5% to give further clearance and the result will be the maximum size of any piece of stone that could pass through the dipper. As an example we will take a 2-yd. dipper. The cube root of 2 is 1.26, which is the dimension of the dipper inside in yards, and multiplied by 36 gives us 45.36 as the inside inch dimension. Reducing this by 5% we obtain a dimension of 43 in. This is the maximum dimension of a stone that will pass through a 2 yd. dipper.

TABLE No. 1

TABLE OF PRINCIPAL SIZES OF SHOVEL DIPPERS WITH SUITABLE SIZES OF PRIMARY CRUSHERS

Size of Dipper (Capacity in cu. yd., level full)	Approximate Clear Opening of Dipper, in inches. Width, lgth. or depth	Suitable Size of Primary Crusher — Type — Jaw Size, in.	Gyratory Size, in.
1½	39	42x40	30
1¾	41	42x40	30
2	43	48x42	30
2¼	44½	48x42	36
2½	46	60x48	36
3	49	60x48	42
3½	51½	60x48	42
4	54	60x48	48

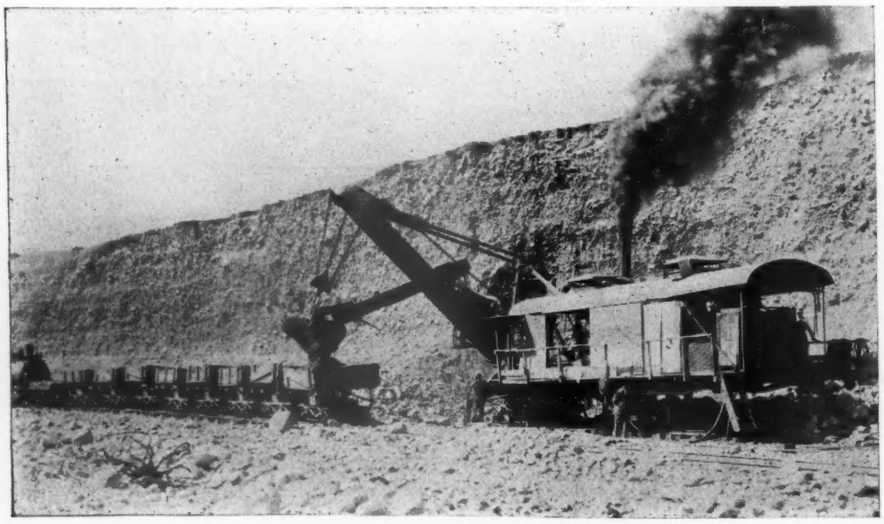


Fig. 1—Railroad type steam shovel

Table No. 1 lists the popular sizes of dipper capacities most commonly used in the stone quarry, and also gives the approximate clear opening of the dipper in inches. Having this dimension we can readily determine what size of primary crusher would be suitable for a given size of dipper. Table No. 1 lists not only the range of dipper sizes with the opening in inches, but also the size of primary crusher which should be used with a given size of dipper, whether it be of the jaw or gyratory type. It is seldom advisable to use a dipper of less capacity than 1½ cu. yd. or a jaw type crusher with an opening less than about 42x 40 in. or a gyratory type crusher with an opening of less than 30 in. for economical operation.

The data given in this article do not take into consideration any type of primary crusher other than the jaw and gyratory types, because these two are so much more used than other types. It is not the writer's intention, however, to ignore the fact that the single roll and hammer type crushers are very efficient for certain conditions under which they serve as primary crushers to the best advantage.

As to the preference between jaw and gyratory designs when choosing a primary crusher there is a difference of opinion. Both types are built in sizes suitable for the shovel dippers in use today, therefore the points to be taken into consideration as to the choice may be summarized as follows:

First cost.

Cost of upkeep.

Which form of feed opening is most desirable.

Which makes the better size of product.

Other facts also enter into the discussion, but these are the most important. As to the first cost, the advantage is often in favor of the jaw type. Of the comparable sizes listed in Table No. 1 there is not a great deal of difference in cost except between the 48x42 in. jaw and 36 in. gyratory and the 60x48 in. jaw and 48 in. gyratory. In these cases the jaw type is considerably cheaper. The cost of upkeep is probably somewhat in favor of the jaw crusher owing to its simple design and accessibility. Fig. 3 illustrates the comparative forms of feed openings and undoubtedly the jaw crusher with its unobstructed opening is very desirable. On the other hand the gyratory crusher, owing to its circular discharge opening, makes a more uniform prod-

uct and is much more desirable when the nature of the rock is such that slabs are produced which may be objectionable. For crushers of equal cost the gyratory type has a greater capacity owing to its large discharge areas and greater speed. The gyratory crusher may be operated at greater speed and also at any desirable speed less than the maximum. The jaw type is limited in its maximum speed, owing to its reciprocating parts. On account of the fly wheel action, which is necessary, the minimum speed is also limited. As to the crushing strength of the two types—the jaw probably is considered the stronger crusher by most operators and engineers. This is due to the fact that more leverage action is obtained in the jaw crusher owing to its toggle arrangement. Briefly the facts may be summed up as follows:

First cost: Often in favor of jaw type.

Cost of upkeep: Not a great deal of difference, but slightly in favor of jaw type.

Form of feed opening: Usually the jaw crusher opening is more desirable.

Product: A much more uniform product is obtained from the gyratory type and less slabs are produced.

Capacity: Greatly in favor of gyratory crusher.

Thus the reader will note that if the product and capacity of a jaw crusher are satisfactory it is desirable as the primary crusher. On the other hand, if slabs in the product are objectionable then by all means choose the gyratory. If capacity is an important feature, then again the gyratory crusher is the best to use. Table No. 2 shows an interesting comparison between the jaw and gyratory crushers as regards weight of machines, sizes of product and capacities suitable for equal sizes of shovel dippers. The figures are averages taken from the publications of various manufacturers and must not be considered as being absolutely accurate, because for the same type and size of crusher opening the weights will vary (in some cases considerably) with the various designs being manufactured at this time.

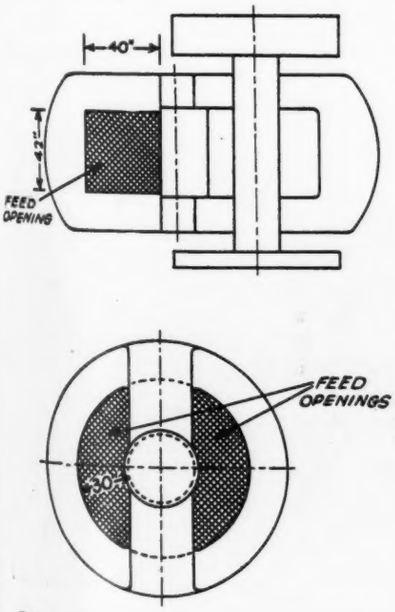


Fig. 3—Comparative forms of crusher feed openings

Fig. 2—Full-revolving, caterpillar-mounted, electric shovel

TABLE No. 2
COMPARATIVE WEIGHTS, SIZES OF PRODUCT, AND CAPACITIES OF JAW AND GYRATORY CRUSHERS SUITABLE FOR EQUAL SIZES OF DIPPER

Jaw Type Crushers				Gyratory Type Crushers			
Size in inches	Weight, pounds	Ring Sizes of Product, inches	Capacity, tons per hour	Size in inches	Weight, pounds	Ring Sizes of Product, inches	Capacity, tons per hour
42x40	105,000	5½-10	120-220	30	170,000	5- 8½	220- 475
48x42	160,000	5½-10	180-320	30	170,000	5- 8½	220- 475
48x42	160,000	5½-10	180-320	36	250,000	7-10	550-1000
60x48	220,000	6½-12	200-380	36	250,000	7-10	550-1000
60x48	220,000	6½-12	200-380	42	350,000	7-10	600-1100
60x48	220,000	6½-12	200-380	48	500,000	8-11	750-1200

Hand-Book of the Rock Products and Clay Industries

MUCH useful and interesting information on the rock and clay industries has been collected and published by the *Tonindustrie-Zeitung* in the form of an annual hand-book called the *Tonindustrie-Kalender*. The book, which is in German, contains chapters on bonding materials, test methods for raw and finished clay products and tables listing the physical and chemical constants of many materials used in building. There are also given German specifications for cement, brick, concrete, etc., and current methods used in testing these materials. A good list of German equipment manufacturers indexed according to their individual product is included.

English Rapid Hardening Portland Cements

ENGLISH portland cement manufacturers have during the last few years been devoting attention to the production of a portland cement having rapid hardening qualities, such as are possessed in so marked a degree by aluminous cements. A considerable amount of progress has been made in this direction, but no genuine portland cement has yet been produced to equal the aluminous cements in strength at early dates. The rapid hardening portland cement tests:

Tensile strength of mixture of 3 parts standard sand to 1 part cement—24 hrs., 300 lb. per sq. in.; 3 days, 650 lb. per sq. in.; 7 days, 700 lb. per sq. in.

Compression strength of mixture of 4 parts Thames ballast ¾-¼ in.; 2 parts sand, ¼ in. down; 1 part cement (by volume)—24 hrs., 1500 lb. per sq. in.; 3 days, 3800 lb. per sq. in.; 7 days, 4300 lb. per sq. in.

Fineness—Residue on 180 by 180-mesh sieve, 1%.

Notwithstanding this difference in strength, considerably more rapid hardening portland cement is being used than aluminous cement for three reasons: (1) The cost is little more than that of ordinary portland; (2) the early strength developed is sufficient to meet the real necessities of most jobs; and (3) being a genuine portland cement, there is not the same feeling of uncertainty as to the permanence of work done therewith.

Should the development of portland cement along these lines succeed to any marked extent it may be found that the use of aluminous cement in England will not grow to very large dimensions. It suffers from the initial handicap that the bauxite has to be imported, whereas the best materials for the manufacture of portland are readily available in this country.—*Contract Journal (London).*

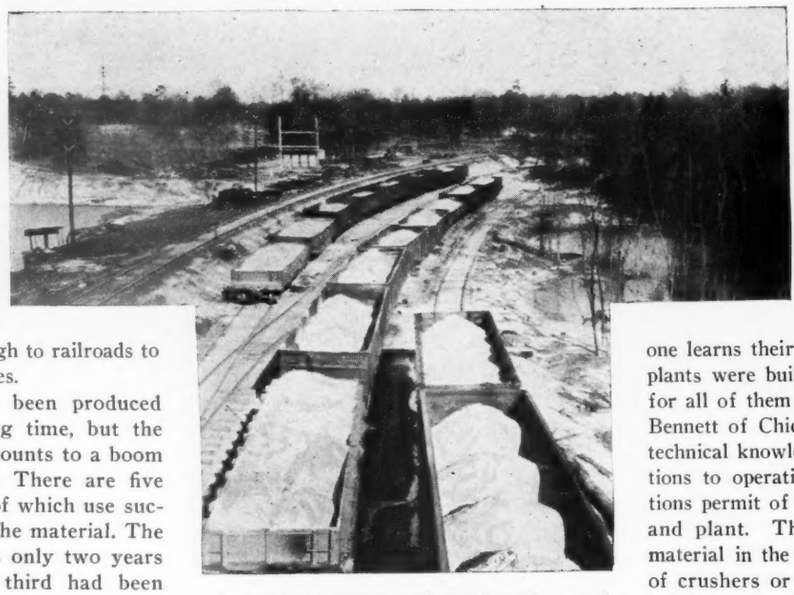
Five Companies Dredging Sand and Gravel at Hattiesburg, Mississippi

Operations Are Along Similar Lines, but with Sufficient Variation to Furnish Abundant Interest to the Visitor

HATTIESBURG is a town of perhaps 20,000 people (it is growing rapidly) in the south central part of Mississippi. It is an industrial town and is on three railroads. It is also one of the comparatively few places in the state in which gravel of good quality is found in deposits large enough to be worked on a commercial scale and near enough to railroads to offer good shipping facilities.

Sand and gravel have been produced at Hattiesburg for a long time, but the industry has had what amounts to a boom in the last year or two. There are five operating companies, all of which use suction dredges to excavate the material. The oldest of these dredges is only two years old; one is building; a third had been just completed but not yet put in service when the district was visited, and the other two are less than a year old. All these are electrically driven. The only old dredge in the district is a steam dredge which is now used as a relay.

The deposits vary considerably in depth and extent and somewhat in quality. There is so little overburden on some of them that no stripping is practiced. But one deposit has 12 ft. of overburden to strip, which is balanced perhaps by the fact that it is the deepest deposit in the field. It has a depth of 65 ft., while the others have depths of 20 to 30 ft.

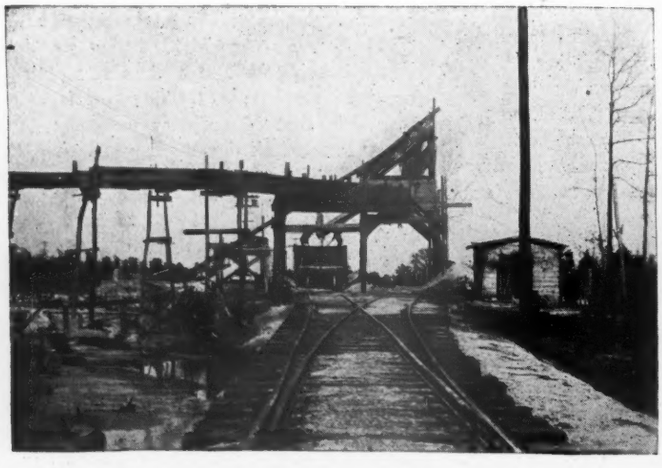


A constant stream of sand and gravel goes from Hattiesburg

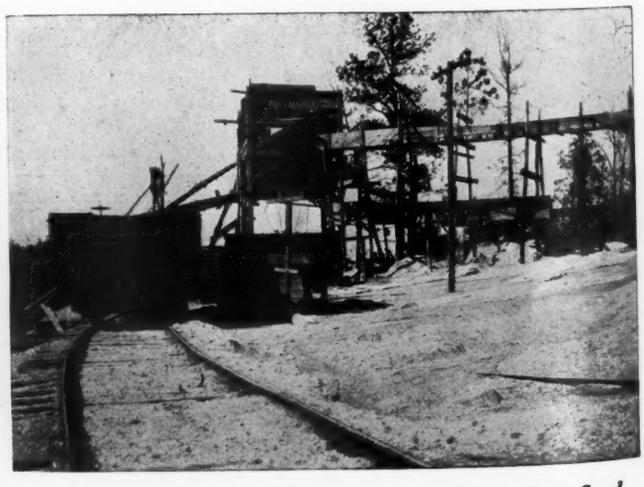
The country is flat and the deposits appear to be in the lowest lands. Some of the ground worked was formerly timbered, and stumps and roots have to be removed as it is worked, but much of it was in cotton fields before it was found to be more valuable for the underlying sand and gravel.

Two of the plants are to be north of the town, two to the south, and one is to the east. All are about the same distance from Hattiesburg, 2 to 2½ miles, and they are all connected to the town by good highways.

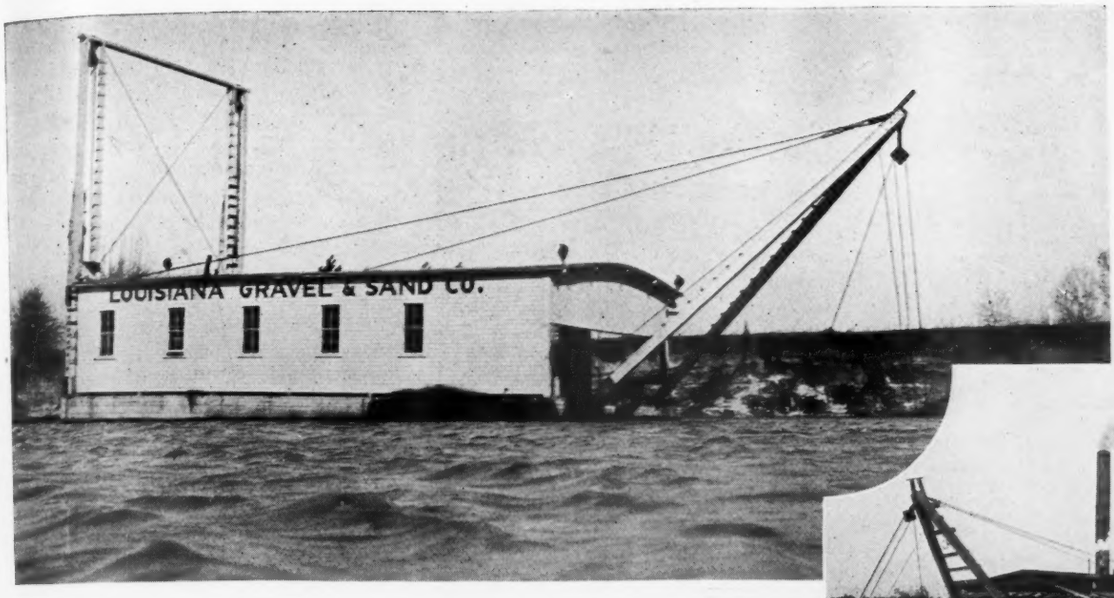
There is a considerable family resemblance among the plants, which is not surprising when one learns their origin. All the dredges and plants were built locally, but the machinery for all of them was furnished by W. H. K. Bennett of Chicago, who gave freely of his technical knowledge in adapting the installations to operating conditions. These conditions permit of simple design in both dredge and plant. There is practically no large material in the deposits, so there is no need of crushers or of arrangements to handle boulders at the dredges. Cutters have been used on some of the dredges, but the ground is loose and dredges easily and a fairly good percentage of solids may be obtained in the pump discharge without the use of a cutter. Only two sizes of material are usually made, a gravel of mixed sizes and a sand which will do for concrete fine aggregate, plastering and the like. Only one plant makes two sizes of sand, but all the plants may be easily changed to make two sizes of gravel when this is required. With so simple a sepa-

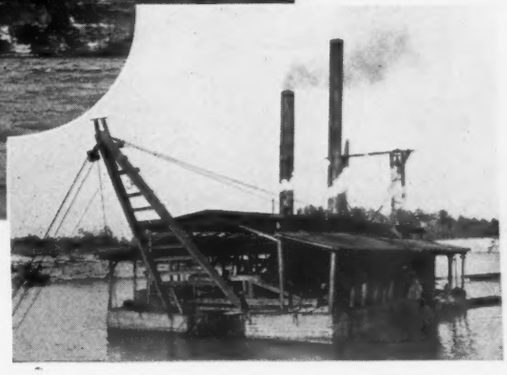


Screening plant of Concrete Gravel Co., with screen set parallel to pipe which discharges directly upon it



Recently installed washing plant of the Hattiesburg Sand and Gravel Co.





New electrically operated dredge of Louisiana Gravel and Sand Co., and below, the old steam dredge used now for secondary pumping

ration to be made, and with the abundant water that comes from dredging, it is only natural that gravity screens should be used, and one sees them in every plant.

But because the plants have certain similarities it does not follow that the industry has been "Fordized." There are considerable differences due to personal preferences of the operators in machinery and equipment, as well as differences which are made necessary by the conditions found at the particular deposit that is worked; in short, those variations which are always interesting to one who likes the sand and gravel business.

Louisiana Gravel and Sand Co. Pumps in Two Stages

One of the two older plants in the district, which is said to be the heaviest producer at the present time, is that of the Louisiana Gravel and Sand Co. It is situated north of Hattiesburg and its workings cover such an area that the material that is now being excavated has to be repumped to get it to the plant.

The primary dredge, which digs the material from the bank, is one of the newer dredges in the district, as it was completed in the fall of 1925. It was designed by the president of the company, N. W. Rockett, who is a mechanical engineer and who is at the head of a machinery manufacturing business in Hattiesburg. The hull of this dredge is considerably larger than any other in the district, about 60x40 ft. This size is necessary because of the length of the suction pipe, 65 ft. The handling of such a suction and the weight of the supporting A-frame require a considerable body and weight in the hull to maintain an equilibrium. The hull is built of a selected grade of yellow pine throughout and solidly braced.

The pump is a 10-in. "Amsco," made by the American Manganese Steel Co. It is driven through a belt which has about 22-ft. centers by an Allis-Chalmers 300-h.p. induction motor. A tightener pulley in a solidly built steel frame insures a constant belt tension.

The handling of the dredge and of the suction is through a 5-drum hoist made by Street Bros., Chattanooga, Tenn., and driven by a General Electric motor. This hoist is of a peculiar design. Three of the drums are set close together in the usual way and these hold the suction line and the swing lines. The other drums are set at some distance to the right and left and handle the two spuds with which the dredge is equipped. The spuds are used in "walking" the dredge. For priming the main pump a small pump, furnished by Street Bros., with a General Electric motor, is used.

The main pump is not of the "underslung" variety usually found on dredges. The discharge pipe extends vertically for about 8 ft. and then is carried at an angle to the rear end of the dredge, where it is joined to the discharge pipe by a rubber sleeve.

Discharge Pipe Rises Vertically from Pump

This unusual construction is used so that the pump may be primed easily. The dredge pumps through a level pipe which will not hold priming water. There was a choice between putting a valve in the discharge line and making a "pocket" including the pump, which is the effect when the suction is raised, or putting the vertical piece in the discharge pipe, and

Dredge of American Sand and Gravel Co.

Dredge of Concrete Gravel Co., which began producing about a year ago with a 6-in. pump set on bank

the latter seemed the best arrangement.

A good feature of this dredge is that the operator is in a glass cabin in the deck house. The controls are brought in through the sides of this cabin.

The dredge pumps to a pond in front of the plant in which is an old steam dredge, also equipped with a 10-in. Amsco pump. This discharges on a fanning table through two old pump shells, which breaks the force of the impact. The discharge falls gently to the table and spreads out to the gravity screen.

This screen is about 20 ft. wide and 10 ft. long and is of ½-in. by 1-in. "Ton-Cap" mesh. A second and finer screen below it receives the discharge when it is desired to make pea gravel, but this was not in use when the plant was visited. The undersize was sent to a sand settling box with three outlets, and the overflow from this settling box to another which catches plastering sand. All the valves to the settling boxes are controlled by hand levers and it is one man's work to attend to them.

This plant is rather more substantially constructed than most of the washing plants in the field, and the screening and sand settling arrangements have been very well worked out.

The Louisiana deposit has to be stripped for a depth of 12 ft., although a good deal of the stripping is fine sand. Formerly a steam shovel was used for this work, but a dragline will be employed in the future. A machine of this sort, bought from the Greenville Gravel Co., and used by that company at one of its Ohio operations, was being set up on the day the plant was visited.

The operation is in charge of I. V. Austin, who is secretary-treasurer of the Louisiana company.

New Inland Sand and Gravel Co. Replaces Burned Dredge

The New Inland Sand and Gravel Co. has worked out a large area at its plant north of Hattiesburg. Its gravel dredge burned last winter and it immediately set about building another, using a part of the old machinery for its equipment. In the meantime it worked the sand which was discarded from its former gravel operations.

Sand settling box discharging into car at Louisiana plant

The company has an old dredge with a 20x30-ft. hull on which is mounted a 10-in. Amsco pump, belt-driven by a 300-hp. Fairbanks-Morse motor. A single-drum "home-made" hoist with a Westinghouse motor handles the suction line.

The peculiar thing about this operation is that the 10-in. pump discharges through a 6-in. pipeline. It was found after the 10-in. pump was started that the sand in the discharge was more than the screening plant could handle. To cut down the output of the pump the 6-in. line was put in, which not only reduced the discharge but also cut down the power required by nearly two-thirds.

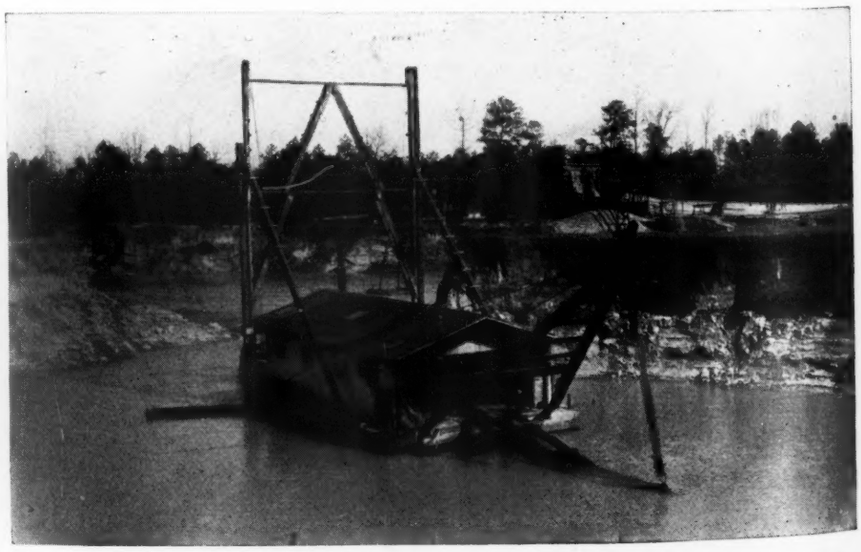
The screening plant is very simple, as the only function of the screen is to keep out trash. The sand goes from the screen into a long settling box with three hand-controlled valves, which is directly over the car to be filled. The sand is exceptionally well washed, as it is really twice washed, and is in considerable demand on that account.

J. J. Haney is manager of the plant.

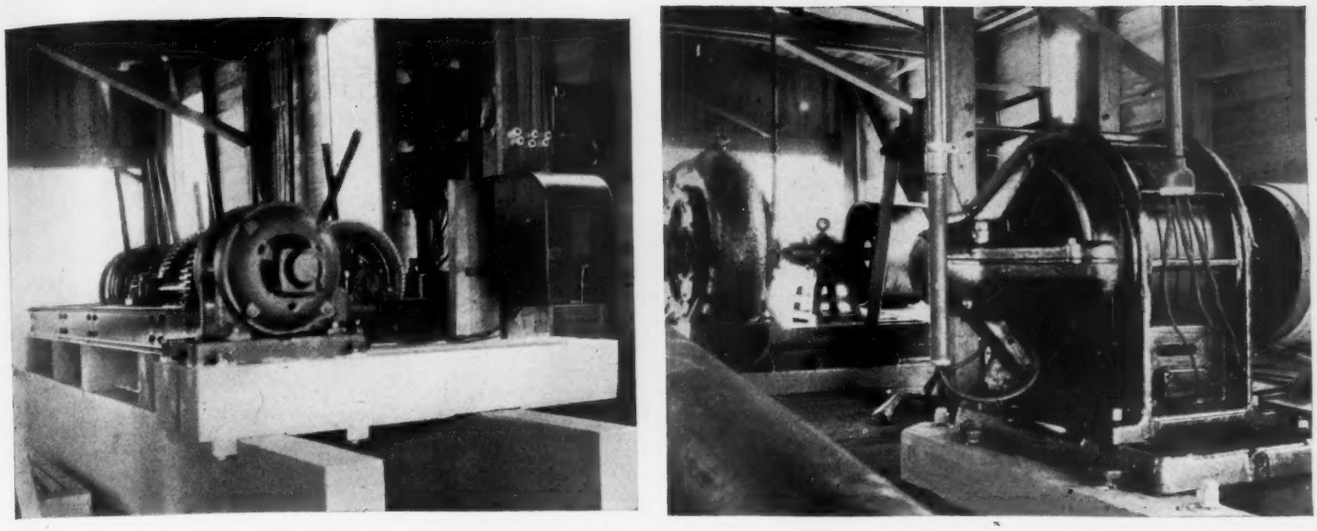
Hattiesburg Sand and Gravel Co. Has New Operation

Mr. Haney is also manager and one of the principal owners of the Hattiesburg Sand and Gravel Co. This is a comparatively new operation, as it has been running for about a year. The dredge has the 24x40-ft. hull which is almost standard in this district, but it differs from all the others in its pumping equipment. It has the only direct connected unit in the field.

This consists of a "Diamond" pump made by the Pettibone-Mulliken company, direct connected to an Allis-Chalmers 250-hp. induction motor which is of the variable-speed type. The rheostats and resistances are placed along one of the walls of the dredge house. The hoist has two drums and was made in a local foundry. This dredge has two spuds, but they are raised and lowered by hand winches. The direct-controlled variable-speed motor is liked by the operator, who said he had had experience with both kinds. A deep-well pump with direct-connected motor is used as a priming pump.



Dredge of Hattiesburg Sand and Gravel Co. has 10-in. pump direct connected to 350-hp. motor



Hoist, pump and motor on dredge of American Sand and Gravel Co.

The pontoon line goes to a riser pipe which is set at 45 deg. so that the discharge is parallel with the screen. This screen is of the usual width and mesh and the oversize (gravel) goes by two closed chutes directly to cars. The undersize goes to a long settling box of the usual type with hand-operated valves.

The American Sand and Gravel Co. is a new concern which has bought ground south of Hattiesburg but had not yet begun production at the time the district was visited. The dredge was completed, but men were working on the screening plant when it was inspected on the last day of February. S. O. Trest is manager.

American Sand and Gravel Co. Has One of Best Dredges

This dredge is one of the best in the district and is in fact about as well designed and built a small pump dredge as the writer has seen anywhere. The hull is the usual 24x40-ft. and it is built of carefully selected yellow pine, all heart timber. There is not a joint in any piece from stem to stern. The interior of the hull is well ventilated by four steel pipes at the corners, carried high enough above the deck to furnish some draft, and so that nothing will be dropped into them.

The main pump is a 10-in. Amsco, belted to a 150-hp. General Electric motor. This seems of low horsepower, but the lift is small and it will be some time before a pipeline of much length is needed to reach the plant. The hoist was made by the Bates Engineering Co. of Chicago. It is of an unusual type, having its five drums in parallel. Two of these are used for the spuds, the others for handling the swing lines and the suction.

The priming pump was made by the Dayton-Dowd Company of Quincy, Ill., and it is a 2-in. centrifugal of the high-duty type.

The Concrete Gravel Co. has a plant south of the town, away from all the other plants. This concern is unusual in that it is a partnership of three men and not an incorporated company. H. M. Willis, one of the partners, is manager, and another partner, L. L. Smith, has charge of operation. The third partner is L. E. Faulkner.

Concrete Gravel Co. Has Growing Business

The history of this company illustrates very well the way the sand and gravel business has grown in this district. One of the partners suggested going into the sand and gravel business less than a year ago, and a start was made with a 6-in. pump and motor placed on skids on the ground, with the suction dropping to a pool. This was because it was not desired to invest too heavily in a business which was somewhat experimental. In a short time the business grew to where the 6-in. pump would no longer give a sufficient production, so a 10-in. pump and motor were brought and a modern dredge built.

Car pullers are used at all the plants

The pump, a 10-in. Amsco, is belt-driven by a motor purchased at second hand. It pumps to a plant of the general type with the discharge pipe parallel to the screen. The sand settling boxes are of the type already described.

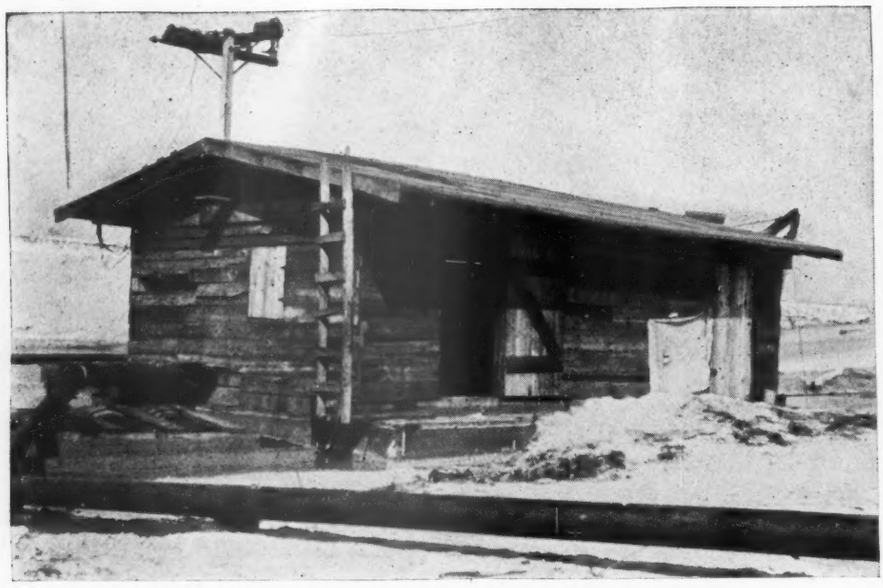
Practically all the pontoons in use employ steel cylinders for floating the pipeline. At the Louisiana plant each pontoon is made of two large cylinders especially welded for the purpose. At some of the others oil drums set in wooden frames are used. All the pipe noted was standard 10-in. pipe, and connections were made with the usual rubber sleeve.

Features Common to All Plants

Every plant uses a car puller to pull the cars through. The washing plants are all set on two parallel tracks. There are no bins. A car on the outside track receives the gravel directly from the screens, and a car on a track directly under the plant receives the sand. At the Louisiana plant, where two sizes of sand are made, a third car on a third parallel track receives the fine sand.

The valves on the sand settlers are peculiar to this district. All of them are what is locally known as "peg valves," that is, the discharge orifice is closed by a cone or peg of either wood or iron. The system of levers by which the peg is moved up and down varies a little in the different plants, but in all the plants the lever is brought to the outside where it can be worked by a man who looks after the loading of the car. The peg valve seems to make a tight closure and to give a good range of adjustment according to the sand that is coming.

There is a much larger proportion of sand than gravel in all the deposits, and a good share of whatever is pumped has to be stored. However, as the experience of the New Inland company proves, this stored sand may easily become an asset.



Dredge of new Inland Co., using 10-in. pump with 6-in. discharge.

The owners realize this and they are not making the mistake that so many plant operators have made when they sold the sand for much less than the cost of production. The price of both sand and gravel is low at Hattiesburg as compared with some other parts of the country, but that is because production costs are low.

Sand and Gravel Recovery Is a Trade

Both white and colored labor are employed, but white labor does the greater part of the work and holds the responsible jobs. Most of the men have had a good deal of experience either in this or in other fields. Sand and gravel men are beginning to be recognized as men having a trade, quite as much as miners and quarrymen. These men know their work and like it and work at it as a matter of preference. During the season the plants run 24 hr. a day.

The gravel is mostly of the smaller sizes and would probably be described as "1½-in. and finer." It is said to make excellent concrete aggregate, the purpose for which most of it is shipped.

With the boom that is going on at Gulfport and Biloxi, Miss., one would think that these would absorb the larger part of the Hattiesburg production, since they are only 100 miles away. But by no means all the production goes there. Shipments are made to Jackson, Natchez, Vicksburg, Meridian and others of the towns that are now building so much in Mississippi. Aggregate is not too plentiful in the central part of the state. Sand is fairly abundant but gravel is not, and there is no crushed stone industry. The state is said to be testing some of the deposits of impure limestone, which one notes from the railroad near Meridian, with a view to using them as a source of aggregate for concrete highways.

This screening plant is typical of the territory

Ohio River Gravel Producers Must Buy Permits from Kentucky Counties

AS a result of an act of the last Kentucky legislature Kentucky counties along the Ohio river now control sand and gravel removed from the bed of the Ohio, on the north side, or past the center of the stream, the land-owners along the Kentucky shore controlling removal from the river channel to the Kentucky bank only. Land-owners on the north bank, or Indiana side of the river, have no control over removal of sand and gravel from the north side to the channel, due to Kentucky having jurisdiction over the Ohio river to the low water mark on the Indiana shore line. This gives the state by counties control over that section of the bed beyond the middle of the stream.

Sand dredging companies now have to go to Kentucky county judges and make contracts and secure permits in order to remove sand north of the channel.

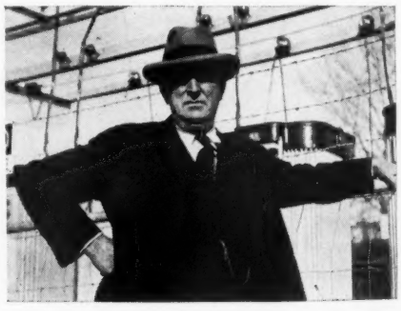
Illinois Third in Production of Molding Sands

ILLINOIS, with a production of nearly 800,000 tons of molding sands per year, ranks third in the United States, according to a report published by the Illinois State Geological Survey. Even this high production is insufficient to supply the Illinois foundries of which there are 200 in the Chicago district alone. More than half of the Chicago foundries use sand obtained out of the state, and about one-fourth of all molding sand used by Illinois foundries is obtained out of the state.

The report continues:

"Eighty-five of the 102 counties are producers of molding sand in varying commercial qualities. Of these, Rock Island, Henry, Peoria, Winnebago and Will counties produce the three types of the best grade of molding sand. Bond, Henderson and Kane counties have the largest number of producers.

"Five counties show undeveloped resources of more than 100,000 tons. Between 200,000 and 1,000,000 tons are estimated for Jo Daviess, and Pope county shows from 180,000 to 1,200,000 tons of untouched deposits.



I. V. Austin, manager of the Louisiana Co. at Hattiesburg, Miss.

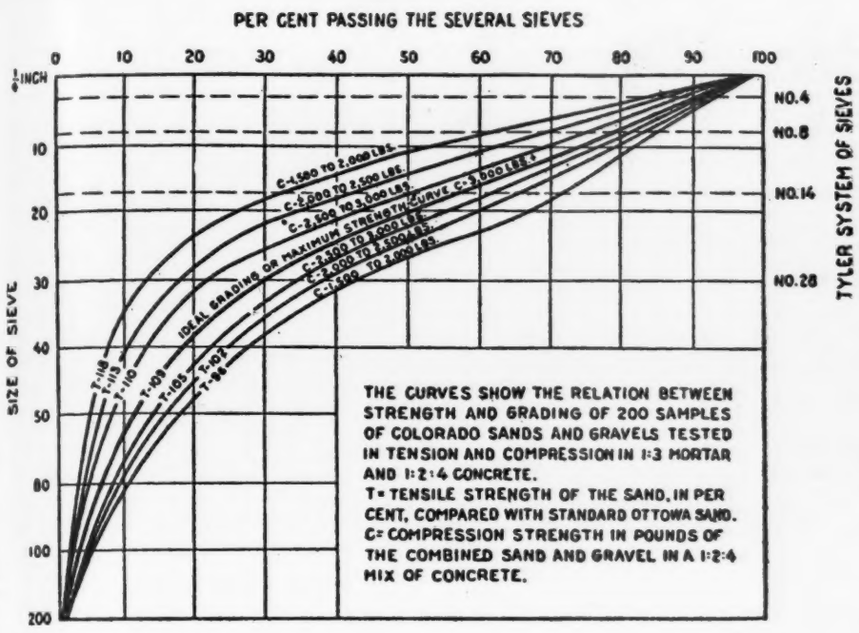
Tazewell, Peoria and Gallatin counties have deposits ranging from 100,000 to 700,000 tons.

"Resources of commercial molding sand alone approximate at least 6,000,000 tons. There are several million tons more not included because of lack of transportation facilities.

"Sand resources of the state are divided into the fine, and the medium and coarse sands. The latter are abundant and will furnish a supply for many years. The fine sands are not so abundant. Besides these grades, the loess or yellow silt sands are found in abundance along the Mississippi river, but are not greatly utilized."

New Road Commissioner

CARL C. RIEPE of Burlington has been appointed by Governor Hammil of Iowa to take the vacancy on the Iowa Highway Commission left by the death of William Collinson. Mr. Riepe is an attorney.


PER CENT PASSING THE SEVERAL SIEVES
0 10 20 30 40 50 60 70 80 90 100
SIZE OF SIEVE
TYLER SYSTEM OF SIEVES
NO.4
NO.8
NO.14
NO.28
C-1,500 TO 2,000 LBS.
C-2,000 TO 2,500 LBS.
C-2,500 TO 3,000 LBS.
C-3,000 TO 3,500 LBS.
MAXIMUM STRENGTH CURVE
C-2,500 TO 3,000 LBS.
C-2,000 TO 2,500 LBS.
C-1,500 TO 2,000 LBS.
IDEAL GRADING OR MAXIMUM STRENGTH CURVE
T-118
T-113
T-110
T-109
T-105
T-107
T-94
THE CURVES SHOW THE RELATION BETWEEN STRENGTH AND GRADING OF 200 SAMPLES OF COLORADO SANDS AND GRAVELS TESTED IN TENSION AND COMPRESSION IN 1:3 MORTAR AND 1:2:4 CONCRETE.
T= TENSILE STRENGTH OF THE SAND, IN PER CENT, COMPARED WITH STANDARD OTTOWA SAND.
C= COMPRESSION STRENGTH IN POUNDS OF THE COMBINED SAND AND GRAVEL IN A 1:2:4 MIX OF CONCRETE.

Strength Affected by Sand Grading

By J. G. Rose

Materials Engineer, United States Bureau of Public Roads

IN connection with the testing of materials for federal aid highway projects in Colorado a study has been made of the relation between the grading of sand for use in concrete and the strength developed in mortar and concrete; and the study has led to the development of a graph which may be used as the basis for a preliminary judgment of the quality of sands proposed for use.

The samples of sand and gravel, or crushed rock, upon which the study was based were contributed by the State Highway Department of Colorado as materials to be tested for use on federal aid projects. Approximately 200 samples of sand and gravel are represented by the study. The source of the materials was widespread, almost every county in the state having contributed one or more samples.

The testing work was done by the Pierce Testing Laboratory, of Denver, and standard methods of testing concrete materials approved by the American Society for Testing Materials were followed in making all tests. Standard briquettes of 1:3 mortar were used for the tensile tests, and 6 by 12-inch cylinders of 1:2:4 mix were used for the compression test specimens. The consistency of the concrete was such as to show a slump of from 1 to 2 inches as determined by the standard slump-cone method. All observations are based upon the 28-day strength of the specimens, both in tension and in compression.

While assembling the test data for the study it was observed that the strength of the 6 by 12-inch cylinders varied from about 1,500 lb. per sq. in. to a little over 3,500 lb. per sq. in. In order to observe the variation in grading between the high and low strengths, the test reports were divided into four groups, each group having a range in strength of 500 lb.; and after computing the average grading of the maximum strength group (3,000 to 3,500 lb. per sq. in.) and plotting this average grading upon the graph, it was observed that part of the reports in the remaining three groups fell above the maximum strength curve, and part fell below it. The three groups were, therefore, divided again into two groups each, depending on whether the grading of the samples fell above or below the maximum strength curve. Samples falling partly above and partly below the maximum strength curve were listed in both groups; and the average gradings for the six groups thus obtained were then computed and plotted on the graph. The groups thus established, according to grading, were then averaged for tensile strength.

What the Graph Shows

The curves derived for the above averages as shown at the top of the page lead to the following conclusions:

1. That there is an ideal grading of sands which will produce maximum strength in concrete.

2. That the ideal grading curve assumes an arched form showing a predominance of the material retained upon the coarser sieves.

3. That for a given mix, there is a practical limit to the quantity of material passing each size sieve, where a given strength of concrete is required.

4. That an exceptionally high tensile strength of sand in 1:3 mortar is not necessarily associated with a high compression strength of the same material when mixed with the average coarse aggregate in concrete, hence the tensile strength is not a proper gauge of the quality of a sand for concrete.

Justification of the relation between the grading and strength of sands as shown by the curves is dependent upon a combination or co-ordination of several well known factors or theories of concrete. The maximum strength curve is, doubtless, associated with maximum density, or minimum voids, in the combined aggregates. The decline in strength as the grading becomes finer is associated with increased surface area, and a corresponding increase of voids. As the grading of the sands becomes coarser than that shown by the maximum strength curve, the probability of increased strength indicated by the surface area theory is overcome by a tendency of the coarser grains of sand to wedge themselves in between the coarse aggregate, thus increasing the voids to such an extent that a deficiency of mortar is produced. Hence, a decline in compression strength is recorded with the increase in coarseness of the sand. This, at least, is one explanation which comes to mind. Probably there are others. The relation of the grading curves to the tensile strength developed in 1:3 mortar bears out the surface area theory; that is, that the finer the sand the greater will be the surface area to be covered by a unit volume of cement, hence, the weaker the bond.

By plotting the sieve analysis of a sand upon the graph, a ready means of visualizing the quality of the material for concrete is produced. The area between the upper and lower curves on the graph forms a practical safety zone for the grading of acceptable sands. If the plotted grading of a sand falls outside of this area, in whole or in part, there is but little chance that it will pass standard specification requirements without increasing the proportion of cement.

In making a materials survey for a project, selection of the best source of supply will be greatly facilitated by a comparison of the mechanical analyses of the samples when plotted on the graph. As a precaution in making selection of a sand, it should be realized that several other factors in addition to the grading affect the strength of sands. Variation in structure and soundness, and the presence of organic matter, silt, clay, acids, alkali and other foreign substances all have their influence on the strength of the sand in concrete. Hence, a considerable variation in strength from the average strength curve for each group shown on the graph should be expected. Eliminating these factors the range of grading for any given strength and mix should be small. Final selection, of course, should always be determined by a more complete laboratory test.—*Public Roads.*

Some Modern Types of European Gas-Fired Lime Kilns*

Solid Fuel vs. Gas for Burning Lime—Characteristics of the Usual Types of Gas-Fired Kilns of Europe

By Alfred B. Searle

THE chief disadvantage of solid fuel for burning lime is the contamination of the lime by fuel ash. Even when fuel is fired on external grates some of the ash is carried into the kiln in the form of dust and contaminates the lime. Hence, when the lime is to be kept as clean and pure as possible, the kiln must be gas-fired.

Other advantages of gas-firing are:

A better control of the heating.

A saving in fuel as compared with externally fired kilns using coal. Gas-fired kilns can also use fuel of more varied composition and of lower quality than the coke, anthracite or coal used in mixed-feed kilns or direct-fired kilns, though where the fuel is of inferior quality a very large gas producer may be required and it will probably be necessary to have a highly skilled man in charge. With a suitable producer a skilled man can burn lime with peat, lignite, waste wood, coke, coal or briquettes, whereas a less able man would only be able to use a suitable coal.

Under ordinary circumstances the coal should not be in very small pieces, slack being much more difficult to gasify regularly than nut-coal. The more uniform the pieces of coal are in size the more easily will they produce a regular supply of gas; a very evenly graded coal consisting of pieces all ½ in. diameter is usually preferable to an irregular coal containing both lumps and dust.

A saving in labor when several kilns are in use at the same time.

Gas-fired kilns of the vertical shaft type also possess all the other advantages of vertical shaft kilns, including:

Ease of filling and discharging.

Efficient use of the heat in the fuel as a result of the preheating of the stone in the upper part of the kiln and the heating of the air by the lime in the cooling zone.

Simple construction and low labor costs.

The chief object in using gas-fired kilns, however, is the superior product made.

The most serious disadvantages of gas-fired kilns are:

They must be worked continuously day and night if they are to be used to the best advantage. Some firms shut off the gas from Saturday noon to Monday morning, but such a practice is far from economical and is better avoided. When once lighted, a gas-fired kiln should work day and night continuously until it is shut down for repairs or lack of trade.

They require constant attention, and as they are chiefly used to produce lime of the greatest attainable purity and best quality they require more skill to manage them. If gas-fired kilns were used to produce lime of the quality obtained from most mixed-feed kilns they would not require any more skill than the latter. Most of the lime burners who have experience of kilns fired with solid fuel and gas-fired kilns agree that the latter are much easier to manage when once the necessary skill has been obtained.

The *capacity* of a gas-fired kiln is about 17% greater than that of a mixed feed kiln of the same dimensions because no space is occupied by solid fuel. It is not wise, however, to build gas-fired kilns any smaller than mixed-feed kilns of the same output because the distribution of heat in a gas-fired kiln is less favorable than in a mixed-feed one.

The output of a gas-fired kiln is less than that of a mixed-feed kiln of the same diameter. There is no necessary limit to the output of a gas-fired kiln if properly designed, and some of the kilns built by Schmatolla have an output of 100 tons of lime per day without reaching the limit. These large kilns are necessarily of the rectangular or annular type; for cylindrical shaft-kilns heated by gas, the maximum internal diameter is about 8 ft., which corresponds to a maximum output of about 30 tons of lime per day of 24 hours when a pure calcium carbonate is burned.

A cylindrical kiln is limited to a maximum inside diameter of about 7 ft. 6 in. to 8 ft., as the gas flames cannot travel across a kiln of much larger diameter. When small pieces of stone are being burned the maximum internal diameter may be as low as 5 ft. 6 in., on account of the greater compactness of small stone. By making a kiln rectangular or oval in plan, its size may be increased to almost any desired extent, provided the gas travels across the smaller diameter which should not exceed 8 ft. and should preferably be much less. Rectangular and oval kilns are difficult to heat uniformly and usually have at least two "cool spots" which the hottest gases do not reach; these are more easily avoided in cylindrical kilns.

All vertical gas-fired kilns closely resemble externally-fired kilns using coal, except that the grates are replaced by pipes or flues conveying the gas from a gas-producer or other source to the kiln.

The gas employed in gas-fired kilns is almost invariably producer gas, though coke-oven gas and natural gas have been employed where they were sufficiently cheap. City gas or illuminating gas is too costly.

Simplest Type of Gas-Producer Best

Various types of gas producers are used in connection with lime kilns, but some of the more elaborate ones do not offer any great advantage, as there is no purpose in preparing a specially clean or pure gas. The simpler the gas-producer the less likely it is to get out of order; mechanically operated gas-producers are quite satisfactory, but usually require more skilled attention than can be afforded by lime-burners. Hence, a simple type of gas-producer with an injector which blows steam and air in suitable proportions through the fuel bed is usually the most generally suitable. In selecting a gas-producer for a lime kiln, the following should be borne in mind:

The bed of fuel should be as deep as possible; if there are several small producers built on to the kiln a fuel-depth of 3 ft. is satisfactory, but if one separate producer is used, the fuel should be at least 4 ft. 6 in. deep and preferably 6 ft. deep.

The supply of steam and air should be capable of accurate regulation.

The grate supporting the fuel should be easily cleaned and of such a pattern that the apertures are not easily clogged.

*Reprinted from the Stone Trades Journal.

The outlet main should be fitted with a dust-trap which can easily be cleaned and with a main gas-valve.

The size of the producer or battery of producers should be sufficiently large to provide more gas than is ever required by the kiln or kilns, without any "forcing," as it is essential to successful working to have an ample supply of gas. Some lime kilns have been seriously hampered by producers of insufficient power.

Mechanical devices for feeding fuel to the producer or for removing ash are not essential; they add considerably to the cost and some of them easily get out of order. Where a skilled mechanic is available, they are excellent and labor-saving, but many lime-kilns are in isolated districts where the requisite skilled labor is not available; for such kilns, a simple, hand-operated producer is preferable.

Four or more small producers built on to the kiln have the advantage of avoiding the loss of heat which is inevitable when a single large producer is placed some distance from the kilns. The small producers are easier to clean and deliver the hot gases more directly to the kiln. They avoid the troublesome weekly "burning out" of the gas ducts, which is often inevitable when a single large producer is used with bituminous coal, but in regular daily work they require more attention than a single large producer. When each kiln has its separate producers it can be worked independently of the others; this is often a matter of great importance, as the loss of output when a single large producer has to be stopped for repairs or cleaning is sometimes very serious. If each kiln has its own small producer any one kiln may be stopped for repairs or because of shortage of orders without interfering with the others. When a single producer, large enough to supply several kilns, is used to supply only one kiln (the other kilns being stopped for commercial or other reasons) the cost of the gas supplied to the one kiln is increased, and the burning will probably be made unprofitable. The chief difficulty associated with several small gas producers grouped around the kiln is that they complicate the construction of the latter, and also they must be comparatively narrow and are therefore liable to work irregularly. This latter objection is overcome by using only four producers—two on opposite sides of the kiln, though unless they are well designed they may leave the other sides of the kiln insufficiently heated. In a properly-designed kiln none of these advantages are serious, and the saving in fuel which is effected by them—especially in times of restricted output—is sufficiently important to justify their use in many works.

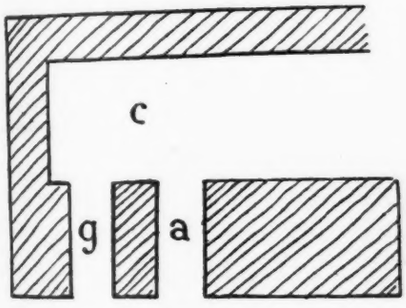
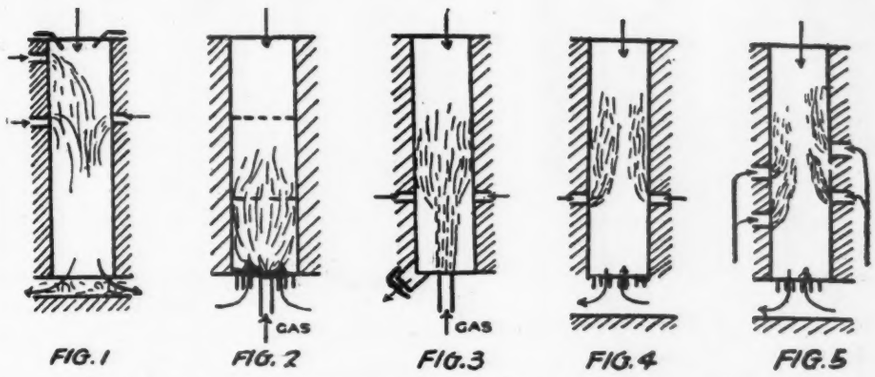


Fig. 6. Burner for gas-fired kiln



Figs. 1-5. Types of arrangement for admitting gas and air to lime kilns

No matter whether several small producers or one large one is used, the gas is introduced at a height of not more than one-third of the height of the kiln, and usually about 8-10 ft. above the draw-eye or lime-exit, the number of gas-inlets or ports depending partly on the size of the kiln and partly on the wishes of the designer.

Number of Gas Inlets Varies

The number of gas inlets varies greatly in different kilns; some (which work quite satisfactorily with some limestones) have only four inlets—two on opposite sides of the kiln—while others have inlets uniformly spaced all around the circumference of the kiln, as many as twenty being sometimes used on a kiln of only 7 ft. 6 in. internal diameter. Theoretically, it is better to have a large number of gas inlets uniformly distributed, but practical considerations often make a smaller number preferable as where there are many outlets they must be small, very liable to choke and difficult to clean. Where these disadvantages can be overcome or at least minimized, the larger the number of gas inlets the better, though many kilns work quite satisfactorily with few inlets.

Although the gas may enter a kiln at any desired point, some are much better than others. If, for instance, the gas were to enter near the top of the shaft and to be drawn downwards and off at the base (Fig. 1) there would be a great waste of fuel, and the lime would be very hot when drawn. Less fuel would be wasted if both gas and air entered at the base of the kiln (Fig. 2), but there would still be a waste and the lime would be inconveniently hot when drawn.

Attempts have been made to use lime kilns with the gas entering at the base and the air about one-third of the way up the shaft (Fig. 3) but if air leaks in with the gas—and it is very difficult to prevent it from doing so—there is a serious risk of explosion. In addition, the lime is usually discolored by smoke in the gas.

A very common arrangement is to admit the gas at the sides of the kiln and the air at the base as shown in Fig. 4, and this is fairly satisfactory though it enables some gas to escape unburned from the kiln. Whether the gas should enter through a series of ports at one level (Fig. 4), or through two or more ports at different levels (Fig. 5), depends partly on the quality of the gas and on that of the stone; usually one series of gas ports is sufficient, though several series have the obvious advantage of lengthening the burning zone and may be preferable when a stone is difficult to burn.

Methods of Introducing Air

The air required to burn the gas may be introduced in two ways:

Primary air which is mixed with the gas previous to ignition.

Secondary air with which the gas comes in contact after ignition.

Some gas-fired kilns use primary and secondary air, but many of those of the older type use only secondary air which rises up through the exit or draw-eye and is heated by the lime in the cooling zone of the kiln.

Some limestones—particularly those containing magnesia—are better burned if some primary air (i. e., air mixed with the gas before the ignition of the latter) is used. Various patterns of gas burner have been suggested for this purpose, one of the oldest being the Bunsen burner in which gas and air are both introduced into a mixing pipe and the mixture is ignited at the end of the pipe. Where the air and gas are under sufficient pressure, a blow-pipe burner may be suitable. A burner used successfully by E. Schmatolla is shown in Fig. 6.

The gas from a producer rises vertically up the gas-duct *g* and into a horizontal duct *c*, while the air rises up the duct *a* into the same duct *c*, the two mixing together before they are ignited. The distance of the ducts *g* and *a* from each other and the length of the mixing duct *c* determine the character of the flame.

The arrangement shown gives a long flame, but if greater mixing of gas and air were permitted a shorter flame would be produced. Theoretically, the use of some primary air is desirable, but in practice it is found that it is not essential and few kilns use it.

Many ingenious devices for providing hot air have been proposed, but most of them are of small practical value. Some of the more important ones are described later.

The *efficiency* of combustion in a vertical gas-fired kiln can be made almost perfect if the kiln is properly designed, as the air and gas can be mixed in almost any desired proportions and flames of any character and length can be produced.

The *distribution of the heat* on a vertical gas-fired kiln can be controlled to a much greater extent than in any other type of vertical kiln. Full advantage may be taken of the hot products of combustion for preheating the stone and of the heat in the lime for heating the secondary air. Flues may also be arranged in the walls of the kiln to preheat the gas and the primary air, if desired.

In short, gas-fired vertical kilns possess all the best characteristics of vertical kilns so far as the control of the combustion and the distribution of heat are concerned.

Various Types of Gas-Fired Kilns

The simplest gas-fired kiln, as previously suggested, is a vertical cylinder of brickwork, preferably enclosed in a steel casing so as to reduce the leakage of hot gases and to strengthen the structure. As previously explained, the diameter of such a kiln is limited by the distance which the flames will travel horizontally when the kiln is filled with stone. Many of the earlier gas-fired kilns had an internal diameter of 6-10 ft., and while those less than 7 ft. 6 in. might attain a sufficiently high temperature, those of larger diameter could only do so with the greatest difficulty, as there is a well-defined distance beyond which the flames cannot penetrate horizontally into the kiln and for most purposes the maximum internal diameter of a gas-fired kiln may be fixed at 7 ft. 6 in. The upper and lower parts of the kiln (i. e., those outside the burning zone) may be of any convenient width, though it is not usually desirable to have them of much greater diameter than the burning zone. Kilns of other than a plain cylindrical shape are considered later.

The Fahnehjelm kiln, which, with various small modifications, has been in use for over 20 years, exists in two types: (1) with small producers built onto the kiln, (2) with a single, separate producer. In both types there is a large central core of brickwork to reduce or avoid the formation of an unburned core of stone. This arrangement has several objections, but it exists in a number of kilns of different patterns which work satisfactorily.

Priests Furnaces, Ltd. have erected several gas-fired kilns (Fig. 7), which have attracted much attention, partly because gas-fired lime kilns are by no means common in this country, and partly because of their characteristic features and the consistent high quality of the lime produced. The general shape of these kilns is cylindrical, care being taken to build them sufficiently high to insure adequate pre-heating of the stone by the products of combustion. The gas in some of these kilns is supplied by a single producer to a main which surrounds the kiln, and delivers gas through several inlets to the interior of the shaft; in other kilns erected by this firm there are four producers, built

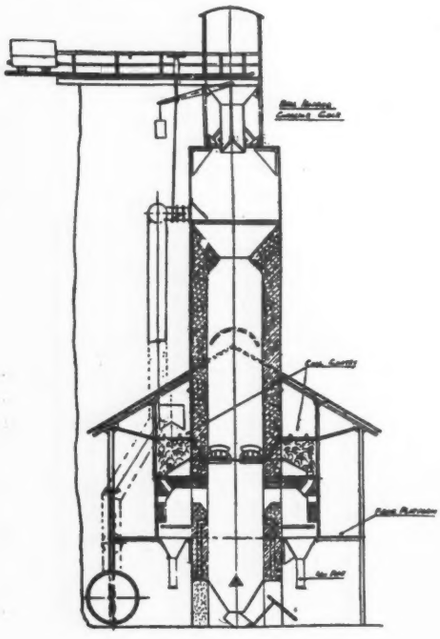


Fig. 7a. Transverse section of gas-fired kiln

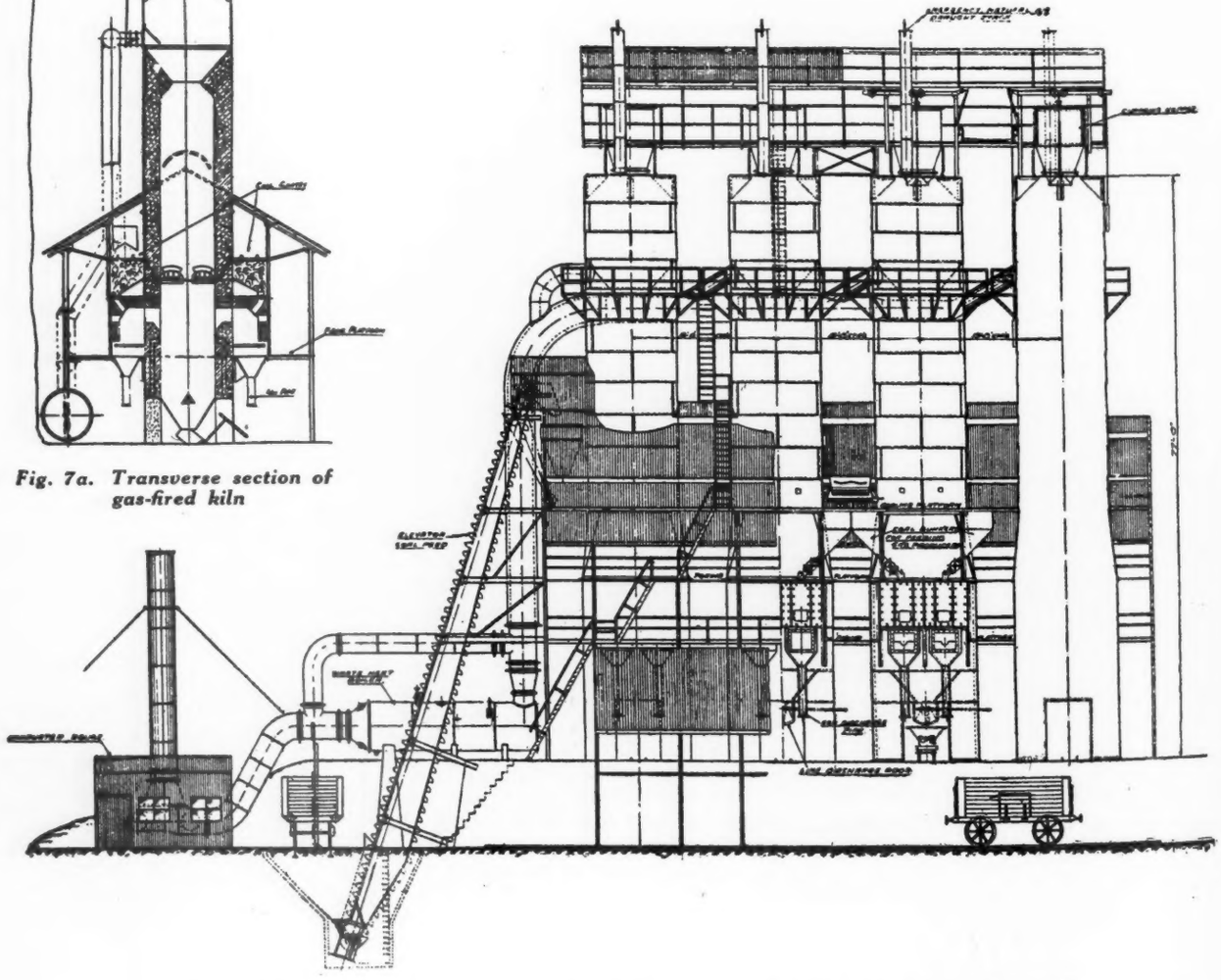


Fig. 7. Cross-section elevation of gas-fired kiln of simple design and sturdy construction

directly onto each kiln, on opposite sides, the gas from these entering the kiln through large ports. The choice of producer depends partly on local conditions, and on the nature of the stone; one large producer requires more fuel on account of the heat lost in transmitting the gas to the kiln, but this may be counterbalanced by the ability of a larger producer to use a cheaper grade of fuel, so that the actual cost of fuel may be reduced by its use.

No primary air is used, all the air required for combustion rising through the cooling lime.

The draught is created by a fan connected by a large duct to near the top of the kiln,

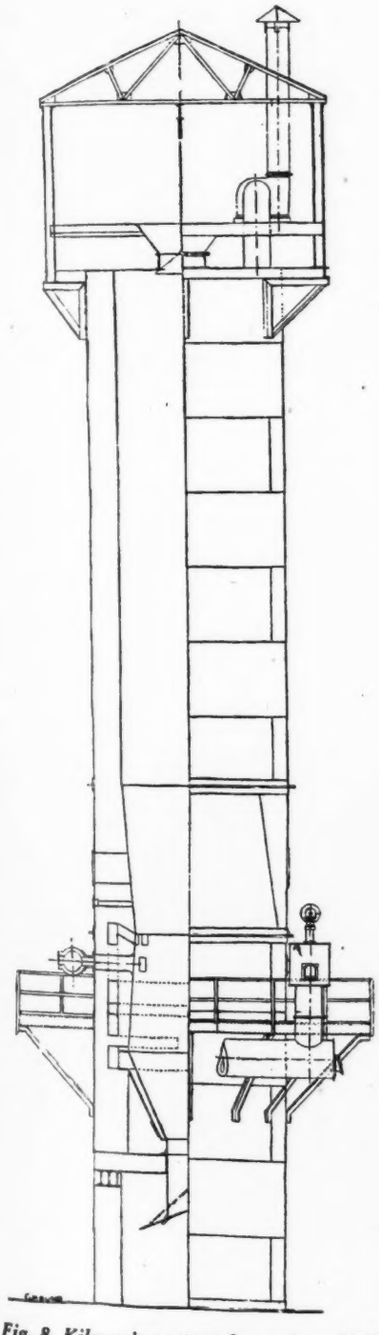


Fig. 8. Kiln using secondary air, which protects the brickwork by blowing the flame towards the center of the kiln

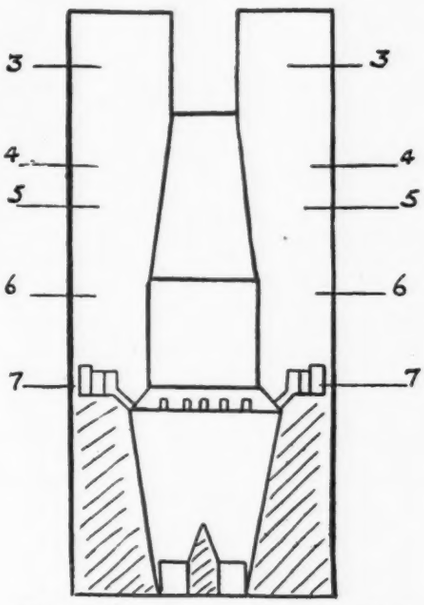


Fig. 9. Kiln designed to impart slow, twisting action to stone as it passes through it

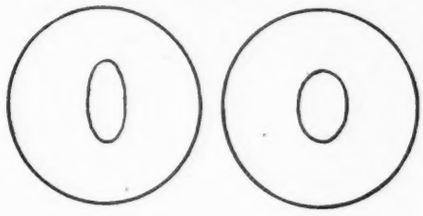


Fig. 10 *Fig. 11*

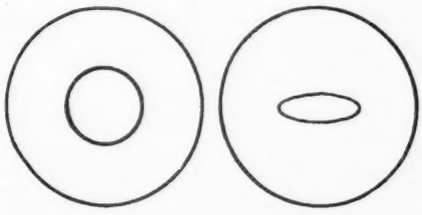


Fig. 12 *Fig. 13*

Figs. 10-14. Cross sections at different places along the kiln shown in Fig. 9

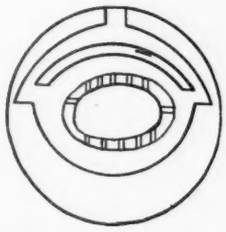


Fig. 14

the gases being drawn off through several openings in the kiln, so as to insure as uniform a draught as possible. The gases are passed through a waste-heat boiler which supplies the steam needed to operate the producer, and also any additional steam injected into the kiln in order to lower the dissociation point of the calcium carbonate. The gas inlets are large and easily cleaned out, but present no other special features. The low fuel consumption of these kilns, compared with some other English gas-fired kilns, appears to depend chiefly on (1) a producer or producers particularly suitable for lime kilns, (2) the use of the heat in the discharged gases, (3) the uniform withdrawal of the hot gases under adequate control by means of a fan, and (4) the general care taken in the construction of the kilns to insure durability and to avoid leakage. These may not appear to be very striking charactertistics, but to anyone familiar with some of the flimsy Continental and American kilns, they are at once recognized as of great importance. Simplicity in design combined with durability, due to good construction, is far more important in a gas-fired kiln than the inclusion of many ingenious devices which tend to weaken the structure, demand increased attention and skill and (except in the hands of men of usual ability) do not compensate for the complications they introduce. For these reasons, Priests Furnaces, Ltd., are probably well advised to refrain from including various supplementary flues which are claimed as an important feature of some other gas-fired kilns; such additions certainly offer distinct advantages, but these are of no use unless the man in charge is both able and willing to make use of them.

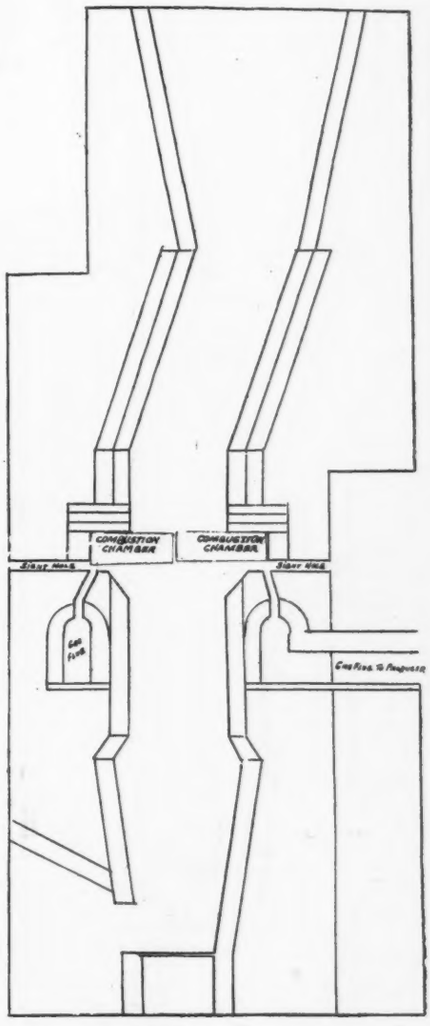


Fig. 15. Modified form of kiln shown in Fig. 9; the upper part is now sloped and a combustion chamber provided over each burner

The Dowson and Mason gas-fired kiln (Fig. 8) has a gas-main surrounding the kiln, with numerous gas-inlets uniformly distributed. It has no primary air, but admits the secondary air in two ways: (a) that which rises through the cooling lime, and (b) that which rises through the space between the double cooling zone, up flues in the brickwork and is discharged through downward-sloping ports immediately over each gas-inlet as shown in Fig. 8. The object of this second supply of air is to protect the brickwork immediately above the gas ports by blowing the flame towards the center of the kiln. A Duff producer with a dog-kennel grate is usually supplied.

F. Crosland's first kiln (patented in 1904) is designed to insure the stone being turned over repeatedly in its passage through the kiln. For this purpose, the shape of the kiln is changed four times as shown in Figs. 9-14, in which Fig. 9 is a vertical section of the kiln and Figs. 10-14 are cross-sections at 3-3, 4-4, 5-5, 6-6 and 7-7 respectively. It is claimed that this form of construction imparts a slow, twisting action to the stone, so that each piece is exposed on all sides to the action of the hot gases. The gas-burners in this kiln consist of a series of ports (Fig. 9), five being arranged on each major side of the ellipse, and one at each end. They are not gas-burners in the strict sense, but only gas ports, no primary air being used.

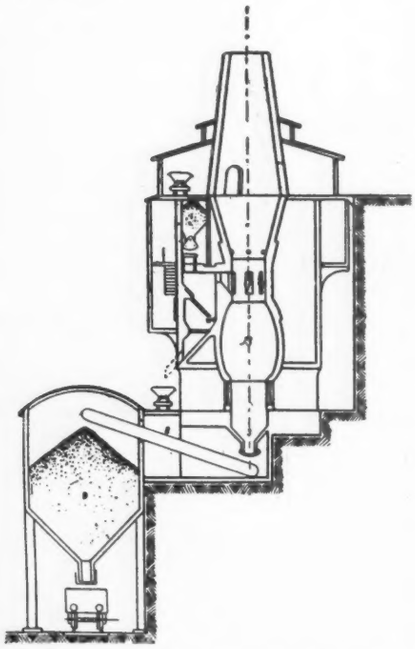


Fig. 16. Kiln design which includes a regenerator for pre-heating the air supply

In a later form of this kiln, the upper part is sloped instead of vertical, as shown in Fig. 15, and a combustion chamber is provided over each burner. The sight holes leading to the combustion chamber can, if desired, be used to supply primary air, and the nature of the flames can be thereby varied to suit local requirements. The shape

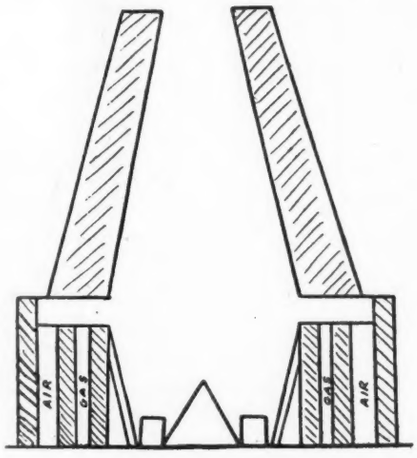


Fig. 17. Modified Aalborg kiln adapted for gas-firing

of the combustion chambers is not satisfactory, as the flames will tend to wear away the overhanging brickwork, but this is easily overcome.

In a third type of kiln (Fig. 16) invented by F. Crosland, the primary air supplied to the gas is heated regeneratively; the flames then travel horizontally across the kiln and most of the products of combustion pass away down a regenerator on the other side of the kiln. Although no chimney is provided, a considerable part of the hot gases must rise up the kiln so that the movement of the gases must be very complex. So far as the author is aware, no kiln has yet been built to this design, though it offers interesting possibilities in several directions.

The gas-fired kilns which are ordinarily supplied by F. L. Smidth, Ltd., are of the Aalborg type (Fig. 17). The gas from a single producer passes into a main surrounding the kiln and thence through several gas-inlets into the shaft. Much importance is attached to the kiln not being more than 4 ft. 6 in. in diameter at its narrowest part, the designers of this kiln being of opinion that with a greater diameter some of the lime will be imperfectly burned. This small diameter limits the output of the kiln to 15-20 tons of lime per day. There is no primary air, all the air required for combustion rising through the cooling lime. This kiln, though widely used, possesses no special features so far as gas-firing is concerned; it is, in fact, a mixed feed kiln to which a supply of gas has been added, special features—important in a mixed feed kiln, but of little significance in a gas-fired kiln—being retained.

Gypsum Beds at Victor, N. Y., Under Development

DEVELOPMENT of the recently discovered gypsum beds at Victor, N. Y., was started when workmen began the sinking of a 135-ft. shaft. This is said to be the first gypsum mining operation in the United States east of Rochester, N. Y. The deposit is being worked by the Victor Plaster, Inc., Rochester, N. Y.—*Syracuse Herald.*

Physical Data on Commercial Building Limestones

LIMESTONE is more extensively used as a building material than any other type of natural stone, and the Bureau of Standards is frequently called upon for information concerning the physical properties of the various producing quarries. For the past three years efforts have been concentrated on collecting and testing representative samples from different producing districts to complete the available data and form the basis of a report on this material. The report which is now being compiled will contain considerable information not heretofore available on the greater portion of this product. Properties of stone not generally studied but of considerable interest in a structural way are elasticity, shearing strength, and permeability.

For the typical limestones the range in modulus of elasticity results is from 3,300,000 to 5,400,000, while for those very dense limestones approximating the texture of marble this property ranges from 7,000,000 to 11,000,000. Shearing strength for the first group ranges between 800 and 3000 lb./in.^{2} and for the second group 3000 to 4400 lb./in.^{2} Permeability results determined on the basis of the quantity of water flowing through a ½-in thickness of stone 1 sq. ft. in area indicate values varying from 1 cu. in. per hour for the average limestones.

An investigation is in progress to determine if limestone under considerable stress finally yields to fatigue under a much smaller load than is indicated by ordinary tests. This question has been studied from the point of compressive and bending stresses. Fatigue tests indicated that 60% of the samples rupture in a short time when submitted to a flexural stress equal to 80% of the indicated strength.

Probably the most important tests made were those to determine the relative resistance of the different materials to frost action. A somewhat different procedure was adopted for this purpose, which involved determining the number of freezings and thawings necessary to destroy the different materials. As compared with the usual manner of performing this test, the time required was very long, and the process would not be at all feasible for ordinary routine tests. These tests, while intended primarily to compare the weathering qualities of different limestones, are expected to supply the necessary data to enable one to judge more intelligently the weathering qualities of stone from simpler tests. The less resistant limestones disintegrated in less than 100 freezings, while some of the more resistant grades have passed 2500 freezings and show only a slight amount of decay. Copies of the official publication giving the results of this work will not be available for distribution to the public for some six or eight months.—*Technical News Bulletin*, U. S. Bureau of Standards.

New Sandt's Eddy Plant of the Lehigh Portland Cement Company—Part II

Coal Mill, Waste-Heat Power Plant and Accessory Buildings Described

OUR issue of August 7 contained a description of the new Sandt's Eddy plant of the Lehigh Portland Cement Co., up to and including the pack house. The coal mill and other parts of the plant are described in what follows. The editors regret the necessity of breaking the article into two parts —but altogether are devoting 19 pages to this most interesting plant.

The coal mill is located to the west of the kiln and mill buildings, as shown on the general plan. Coal is received at the plant in a steel-lined track hopper, from which it is fed by an apron conveyor to a 24x24-in. roll crusher which in turn discharges to the boot of an elevator. This elevator discharges to a steel bin of 34 tons capacity, from which the coal is fed by an apron conveyor feeder to the 5½x42-ft. coal dryer. The coal dryer is driven by a 20-hp. induction motor, 440-v., 680-r.p.m., through a 48.5 to 1 spur-gear reducer.

The dryer uses pulverized coal for fuel and is equipped with a recording thermometer to maintain a temperature of about 450 deg. F.

The dried coal as it comes from the dryer is elevated to a 37-ton steel bin, from which it is fed by gravity to a battery of three 46-in. coal mills, each direct-connected to a 100-hp., 2200-v. induction motor running at 499 r.p.m. The coal mills discharge to a common screw conveyor feeding one of two 6-in. air-coal (pneumatic) pumps, one being a standby. The conveyor is direct-driven by a 5-hp., 440-v., 865-r.p.m. induction motor through an 18 to 1 spur-gear reducer, and each coal pump is driven by a 15-hp., 440-v., 865-r.p.m. induction motor with direct connection.

Pulverized coal is pumped to a 3-ton bin feeding the coal-dryer burner and to bins feeding the kiln burners in the kiln house, each of which holds 28 tons. The coal pipe lines between the coal dryer house and the kiln building are in underground conduits.

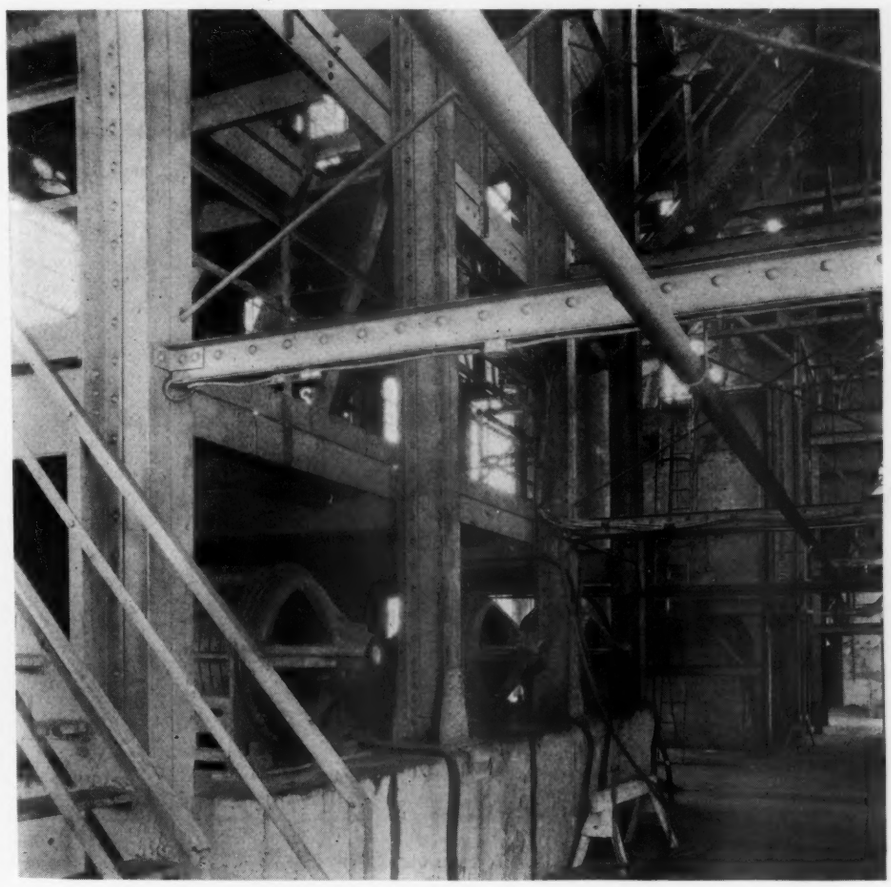
Waste Heat Power Plant

The waste-heat from the kilns goes to two 930-hp. waste-heat boilers of the latest design; the gases, after passing economizers and feed-water heaters, are discharged into a single concrete stack. A 500-hp. auxiliary, or standby, boiler is provided, which is fired by oil or pulverized coal. The plant may be started with this boiler, but full operation, with the quarry requirements, makes necessary the use of both waste-heat boilers, or one waste-heat boiler and the auxiliary boiler. The auxiliary boiler can be started up with oil fuel, using a portable gasoline-engine driven blower. This, of course, is only necessary until the coal mill is in operation.

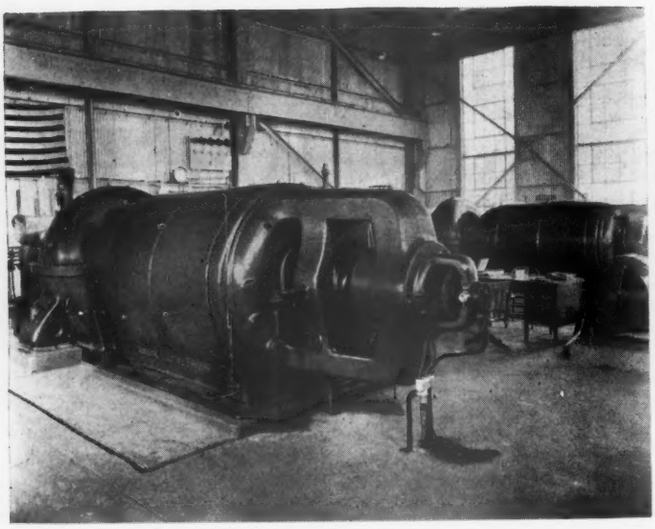
Steel hoppers feeding a system of screw conveyors, in a well-lighted basement under the waste-heat boilers, collect the dust from the boiler flues and bring it to the boot of an elevator, which discharges it to a feed bin where water is added and it joins the slurry at the kiln feed tanks. These conveyors all have direct drives, using 5-hp., 440-v., 865-r.p.m. induction motors and 18 to 1 spur-gear reducers.

The power plant has two 2500-kw. steam turbine-generator units. The turbines are 13-stage and take steam at 175 lb. Their speed is 3600 r.p.m. The direct-connected generators are 3125-k.v.a., 2300-v., 2500-kw., 60-cycle, and of course run at 3600 r.p.m. In addition there are two direct-connected motor generator units producing 250 v., 360 amperes, at 1200 r.p.m., driven by 135-h.p., 2200-v. induction motors. Besides the direct current required for the generator exciters and super-synchronous motors, considerable is used about the plant for variable-speed motors, as already noted. There are approximately 180 motors in the plant, totaling 4300 hp., and 87 geared speed reducers.

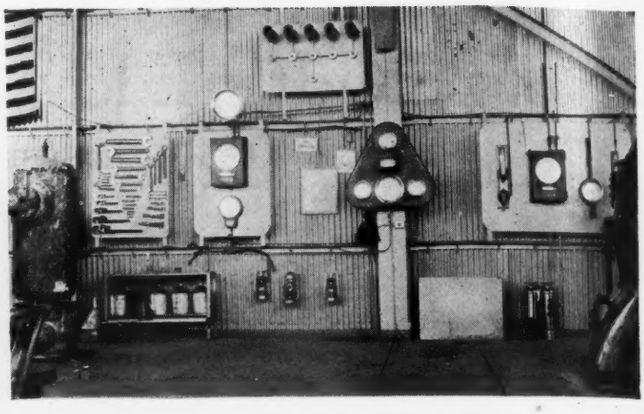
The slate-panel switchboard is of the latest design and is equipped with electrical indicating and recording instruments for every purpose. The instrument board for the steam power end of the plant is also shown in one of the views. No central power station is better equipped with similar indicating and recording devices for the making and distribution of economi-



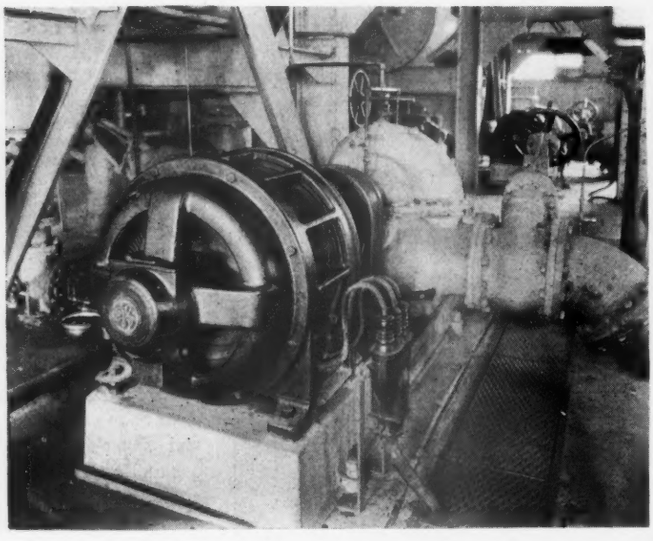
Interior of coal mill showing dryer in background, motor drives on mills



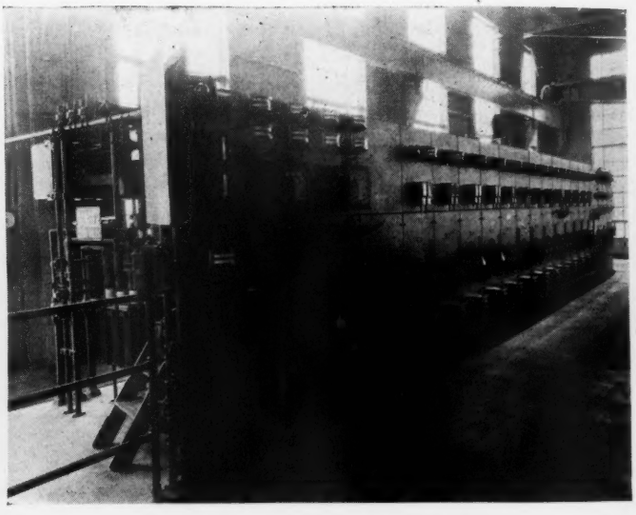
Steam-turbine generator units in waste-heat power plant



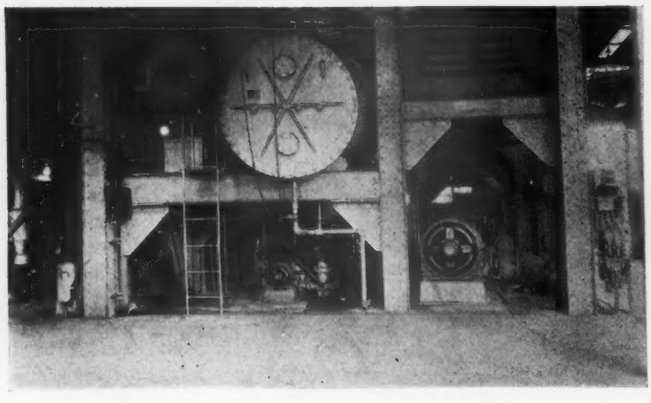
Instrument board on boiler side of power plant



Basement of power plant showing auxiliary equipment



Switchboard in power plant



Condensers and condenser pumps under turbines

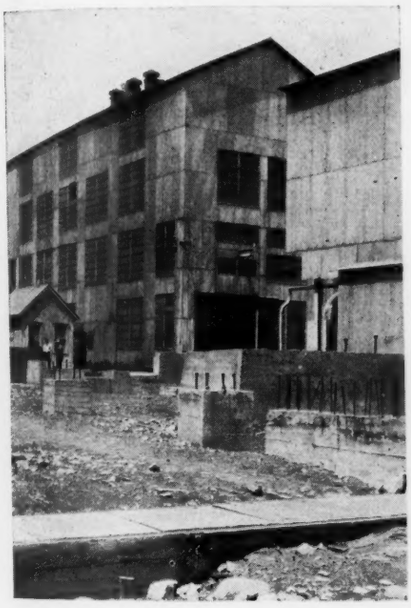
Air compressors in basement of power house

Views of waste heat power plant and auxiliary equipment, forming what is without doubt the most modern plant of this type in the cement industry

cal power. A 20-ton overhead traveling crane serves the generator room of the power plant.

Electric power is distributed throughout the plant by parkway cable in conduits. All switches are of the standard safety type used exclusively in all the Lehigh company's plants. Both 2200- and 440-v., 60-cycle, alternating, and 250-v. direct, current is used for power about the plant.

The ground-floor room under the generators is equipped with various auxiliary machinery, including the turbine condensers and condenser pumps, the boiler feed-water pumps, centrifugal oil filter, etc. The condenser pumps are driven by direct-connected



Coal mill building showing conduit in foreground which houses cement pipe lines from mills to silos (looking west)

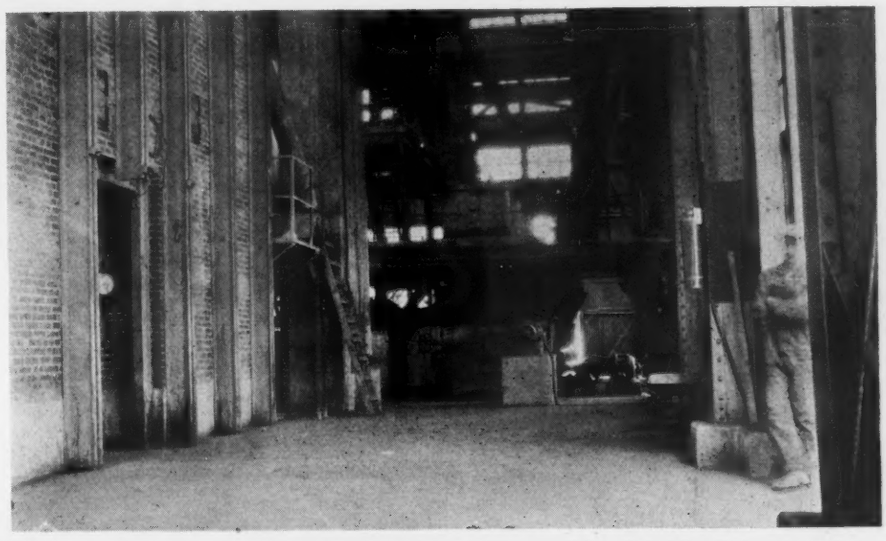
100-hp., 2200-v., 865-r.p.m. induction motors. A centrifugal pump and motor unit is provided for fire service, but is so connected that it may also be used as an auxiliary service pump.

The ground floor of the power plant also contains two compound air-compressor units, one direct-driven by a 215-hp., 2200-v., 257-

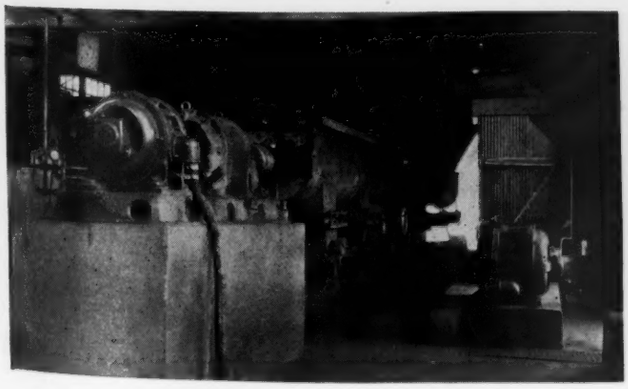
Corner of coal mill showing mill building and slurry tanks at left—looking east. Car puller at corner of building

r.p.m. synchronous motor and the other by a 150-hp., 2200-v., 257-r.p.m. synchronous motor. These furnish the air for slurry agitation and other purposes about the plant.

In addition to the buildings enumerated there is a splendidly equipped machine shop, served by an overhead traveling crane, of 5 tons capacity, a portable electric welding outfit, and the usual machine tools, all having direct-connected individual motor drives. This building is structural steel and concrete, with a gypsum slab roof. This building is heated

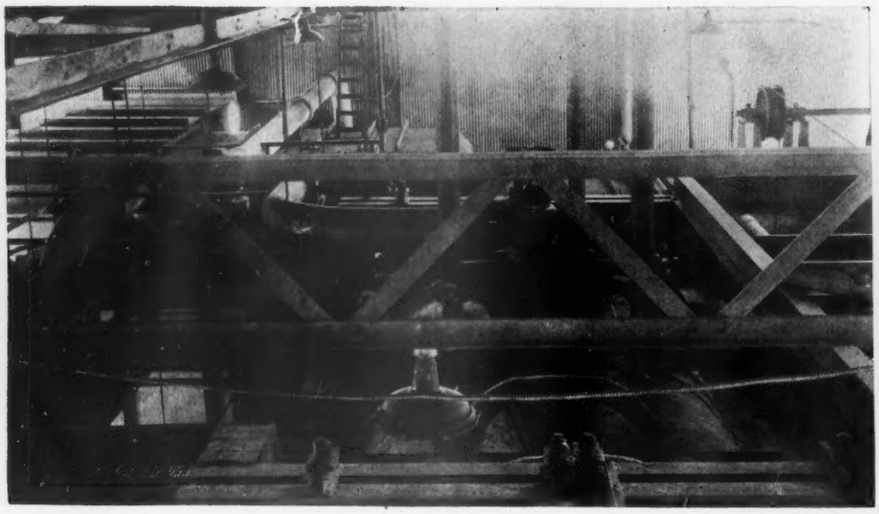


Interior of coal mill, dryer in left foreground, mills in center

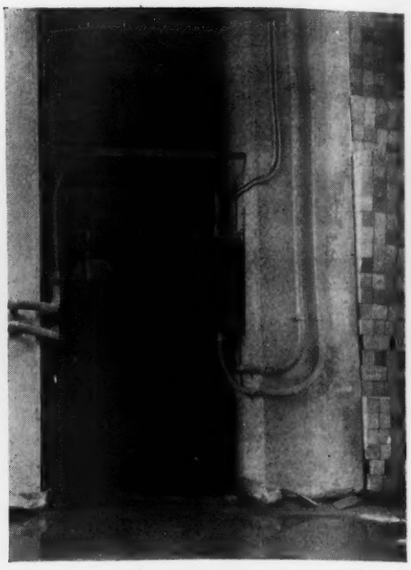


Pneumatic pumping system transferring pulverized coal to kilns

Another view of pneumatic pumping system in coal mill, one pump disconnected



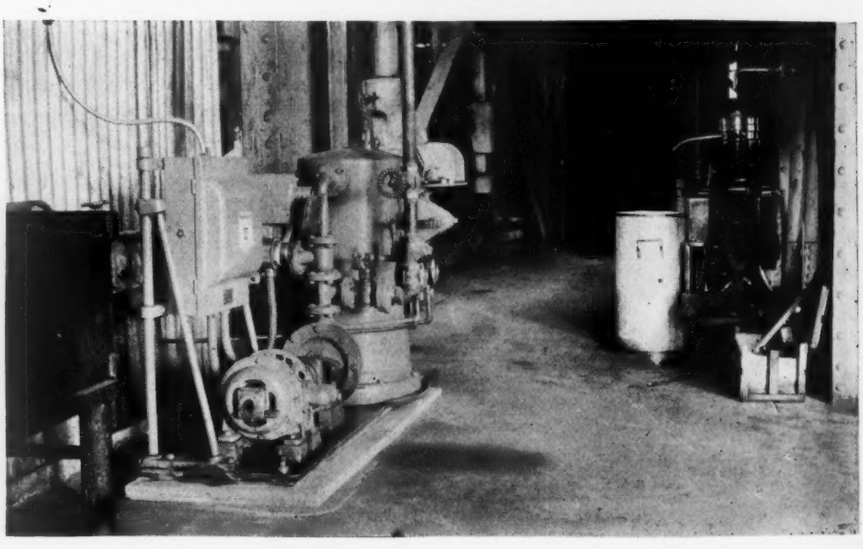
Looking over tops of waste-heat boilers, showing headroom and accessibility



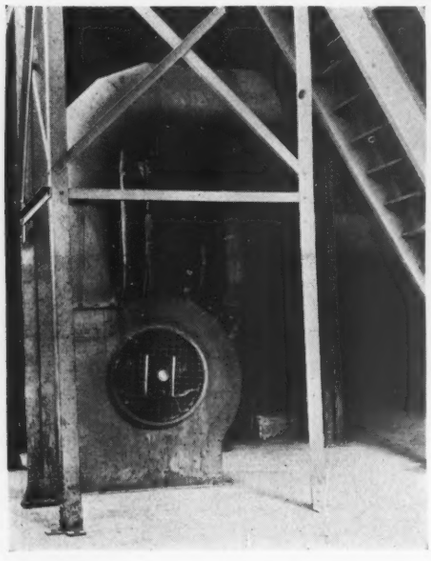
Kiln control switches in kiln foundation

by an overhead, electrically-operated heating and ventilating system.

There is also an employes' washroom, with shower baths and a locker room, using clothes hangers which are suspended from the ceiling by locked chains. The foremen have a separate washroom, locker house and office.

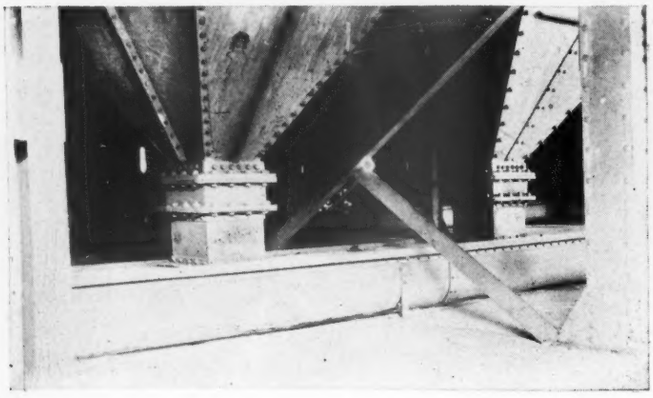


Feed-water pump and centrifugal oil separator in power house

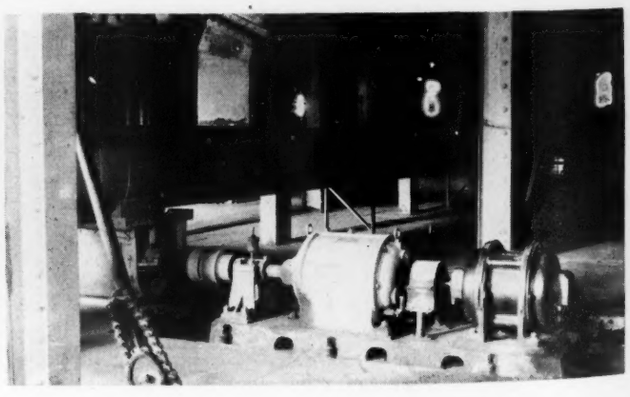


Auxiliary standby boiler for starting and emergency use

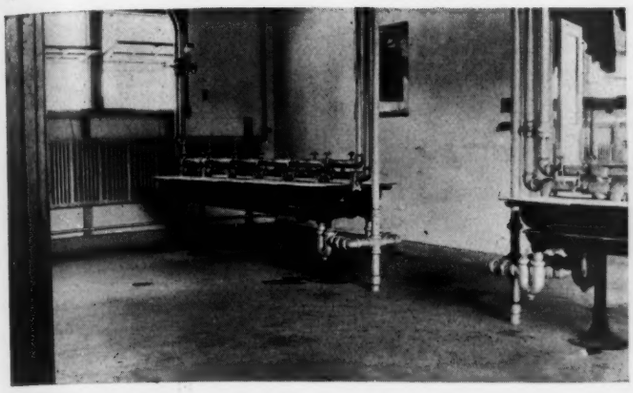
The plant office is a pretty stucco building, on a terrace, approached by a concrete-paved driveway. This contains a private office for the superintendent, the accounting offices, washrooms, etc., and a well-equipped laboratory. To the west of the office building is a neat and attractive hospital building. To the east of the plant office building is a



Dust hoppers and conveyors under waste-heat boilers returning dust to kilns



Another view of screw conveyor system under waste-heat boilers



Washroom in employes' house

Interior of machine shop

row of neat stucco dwelling houses.

All the main buildings, except those otherwise noted, are of structural steel covered with both zinc and galvanized-steel corrugated siding. Floors and stair treads throughout the plant are of the well-known "subway" grating. Foundations have been placed for two additional kilns, and in the power-house space is provided for one additional turbine generator and auxiliary equipment. With the exception of additional grinding machinery, space for which is provided, as already noted, and doubling of the silo capacity, the plant is designed for four kilns

The Public Service Production Co. of Newark, N. J., were the constructors of the Sandt's Eddy plant, under contract with the Lehigh Portland Cement Co.

The officers of the Lehigh Portland Cement Co., whose home office is at Allentown, Penn., are: Harry C. Trexler, chairman of the board of directors; E. M. Young, president; Daniel E. Ritter, vice-president and general manager; B. L. Swett, vice-president and eastern sales manager; B. H. Rader, vice-president and Western sales manager; Ernest Ashton, vice-president and chief chemist; Joseph S. Young, vice-president and assistant to the president; Raymond R. Bear, vice-president and chief engineer; F. E. Paulson, vice-president and traffic manager; Alonzo F. Walter, secretary and treasurer. "Jimmie" Gish—so known to portland cement men all over the United States and Canada—formerly superintendent of Bath Portland Cement Co., is superintendent of the Sandt's Eddy plant, and was the superintendent of construction.

Row of employes' houses at Sandt's Eddy

Laboratory in the plant office building

Russian Cement Import Causes Tariff Controversy

ARRIVAL of 80,400 bags of cement from Russia, consigned to the Amtorg Trading Co., the soviet government's commercial establishment in the United States, opens up a question of customs law. There is a countervailing duty on cement from countries that impose a duty on American cement. Not recognizing the soviet government, the United States can take no official cognizance of its customs regulations. The cement, however, has been admitted, presumably on the theory that the soviet admit American machines and other products.

T. W. Newton P. C. A. Field Engineer

T. W. NEWTON has been appointed a field engineer for the Birmingham office of the Portland Cement Association and is assigned to products promotion. Mr. Newton is a graduate of the University of Alabama and for the past several years has been employed in the construction department of the Tennessee company.

Stone at right as shot down and fed to crusher without mudcapping. At left are storage piles and loader

Engineering Study of Crusher Performance

Made at Plant of Fehr and O'Rourke Stone Co., Shillington, Penn.

THE persistency with which some rock products producers will work with their equipment until they get the whole plant synchronized and up to the desired capacity has been noted a number of times in these pages. Sometimes it is done by the application of engineering principles, and sometimes it is accomplished along the more primitive lines of trial and error, just as a cat will eventually find its way out of a dark cellar. But however it may be brought about, there are those who will be satisfied with nothing less than the highest attainable efficiency, and will work patiently until the goal is reached.

This is the story of one such operation. Perhaps it would be too much to say that it has even yet reached its limit of efficiency. In fact, we shall probably point out one or two places where it still has its problems. But it has made advances which may be taken as indicative of what it will accomplish still further.

The plant under consideration is that of the Fehr and O'Rourke Stone Co. at Shillington, near Reading, Penn., and it has by taking careful thought raised its production from 250 tons per day to over 1000 tons, the unit cost of production going in the opposite direction meanwhile.

The stone quarried by this concern is a very hard limestone in a dense formation, with no pockets of clay or gravel, and under ordinary blasting methods breaks up in large pieces, many of which have to be broken by secondary blasting. It was to meet this condition that the crushing methods have been changed at various times. The stone is used principally for highway work.

Regarding the changed conditions in the quarry, J. S. Hildebrand, superintendent, states:

"Before the larger crushed was installed, a large part of the stone had to be broken down in the pit. This involved considerable expense for labor, dynamite, fuses and caps. The main objection to mud-capping was the annoyance to the residents of Shillington. Since our new crusher has been in use, we have been able to avoid this expense and have the good will of the residents, many of whom believed that we had shut down, whereas we were actually producing more stone than before. Sledging was slow and hard work, and the men are glad to have it eliminated."

The original plant consisted of a small 11x26-in. jaw crusher, with an elevator, screen, small loading bins and a small set of rolls for reducing the tailings. After the quarry had been opened up and the stone was breaking too large for this crusher, a larger one, 22x50-in., of the same type was installed, together with a ¾-yd. gasoline shovel for loading the stone in the quarry.

Large stone being fed to crusher

The stone broke too large, however, even for the 22x50-in. crusher, and in July, 1925, a 36x48-in. Buchanan Type C all-steel crusher was installed. It was then found that another shovel was needed in the quarry, and since the new crusher would handle larger pieces than the ¾-yd. shovel, a second Pawling and Harnischfeger gasoline shovel, with a 1¼-yd. bucket, was put into service in March of the present year.

The two shovels load the stone into 3-yd. quarry cars, which are drawn by cable up the incline to the mouth of the Buchanan 36x48-in. crusher. This crusher reduces the stone from size receivable to approximately 5 in., the jaws being set at 5½ in. The crushed material is mostly cubical, very few slabby pieces going through.

At times the plant has handled 35 cars an hour, equivalent to nearly 900 tons in a 10-hr. day, and the crusher would be able to handle material at this rate if the quarry were able to supply it. This is one of the points where further efficiency work can be done.

The material is then elevated from the primary crusher and chuted to the old 22x50-in. crusher, now used as a secondary crusher, which reduces the stone from 5 in. to approximately 2 in. or 2½ in. It is then elevated to a sizing screen and the oversize passes to a No. 37 Kennedy gearless crusher, which was installed last February, and which reduces the oversize to approximately ¾ in. size.

An engineering survey of the operation of this plant was made recently by the A. C. Nielsen Co. of Chicago, who are specialists in checking up on industrial performance. It is shown by this report that the plant production has increased at least 25% since the larger crusher was installed, without any increase in labor cost. The plant is saving, therefore, not only the cost of reducing the stone to a size suitable for the old crusher, but also the cost of the added labor and the additional plant and overhead expense, otherwise required to maintain present production. These may be considered as proportional to the production increase.

The total of fixed charges and overhead expense on the old equipment was $85.00 and the saving in this item is $21.25 a day because of the 25% increase in production. The labor cost is $94.60 a day, with a similar 25% saving of $23.65 a day. The former cost of reducing stone to a size suitable for the crusher is wholly saved, an item of $22.00 a day. These amount to $66.90 a day.

In order to effect these savings this company installed not only the crusher, but auxiliary equipment at a total investment of $35,000. Operating costs, including all expenses except labor, amount to $32.51 a day.

The net saving is therefore $34.39 a day, or $7,565.80 a year. This is a net annual return of 19¾% on total investment in the primary crusher plant.

The cost of operating the large crusher is given by the engineers in detail as follows:

Investment:		
Crusher, installed		$16,470.00
Motor and controls, installed		4,000.00
Depreciation: $20,470.00 ÷ 12 years		$ 1,705.83
*Average interest at 6%:		
13 × $20,470.00 × .06 / 12 / 2		655.27
Annual allowance for repairs and repair labor (estimated)		450.00
Lubrication:		
No. 4 cup grease—		
55 lb. × 40 wk. × $0.10	$220.00	
Oil for toggle seats—		
2 gal. × 40 wk. × $0.25	20.00	
Motor oil—		
¼ gal. × 40 wk. × $0.58	5.80	245.80
Total of above items		$ 3,056.90
Daily cost for above items (average)—		
$3,056.90 ÷ 220 days		$ 13.89
Power:		
Driving motor—		
33.3 kw. × 10 hr. × $0.0235		7.83
Cooling water pump motor—		
.3 kw. × 10 hr. × $0.0235		.07
Labor charged to crusher (starting, oiling and inspecting)—		
1½ hr. × $0.65		.98
Total of above daily costs		$ 22.77
Labor (dumping cars into crusher)—		
2 men × 10 hr. × $0.50		10.00
Total daily cost, including labor for dumping cars		$ 32.77
Cost per average ton, excluding labor for dumping cars—$22.77 ÷ 500 tons		$ .0455
Cost per average ton, including labor for dumping cars—$32.77 ÷ 500 tons		.0655

*Allowing for interest earned by depreciation reserve.

In making up these figures the cost of crusher and motor, including freight and installation expense, is depreciated on a basis of a 12-year life, which is conservative, as it is expected the crusher will be good for 15 to 20 years of service. An annual allowance for repairs and repair labor of $450 has been made. In an average year the plant operates about 40 weeks of 5½ days each, or 220 days, and this factor is used in reducing annual costs to a daily basis. The labor charged to the crusher for starting, oiling and inspection amounts to only $0.98 a day. Power costs $7.90 for a 10-hour day. The total cost of operating the crusher is $22.77 a day, or $0.0455 a ton, at present production.

If the labor of two men, who dump cars of stone into the crusher hopper, is considered, the cost of operation becomes $32.77 a day, or $0.0655 a ton.

Power is supplied to the Buchanan crusher by a 125-hp. induction motor with a full load speed of 585 r.p.m., through a 6-ply 18-in. rubber belt. The motor is of ample capacity for the peak load, as shown by tests made by the Metropolitan Edison Co. and a representative of the A. C. Nielsen Co., to determine the power input to the crusher under varying load conditions. An Esterline-Angus graphic watt-meter was employed and a curve traced by it, showing the power input during a typical period.

The peak starting load was found to be a maximum of 100.8 kw., which is less than the normal full load rating of the motor. The maximum instantaneous input at any time during the entire test, under the heaviest load conditions, was 102 kw. From the chart the average no-load input was found to be 20.4 kw. and the average load over a 10-hr. period, during which 500 tons of stone was crushed, was 33.3 kw.

The working time of the crusher, during which stone is actually passing between the jaws, is less than one-half the running time. The curve plotted by the engineers shows that the crusher could handle at least twice the stone supplied during the test if it were possible to speed up production at the pit. During the month of March, 1926, the average daily production was close to 500 tons.

The cost of operating the complete primary crushing unit, including crusher, bucket elevator and auxiliary equipment is given by the engineers as follows (not including labor):

Depreciation—$35,000 ÷ 12 years		$2,916.67
*Average interest at 6%:		
13 × $35,000.00 × .06 / 12 / 2		1,137.50
Annual allowance for repairs and repair labor (estimated)		700.00
General maintenance, including lubrication and inspection		350.00
Total		$5,104.17
Daily cost of above items (average)—		
$5,104.17 ÷ 220 days		$ 23.20
Power cost (33.3 kw. ÷ .3 kw. ÷ 6 kw.)—		
39.6 kw. × 10 hr. × $0.0235		9.31
Total cost of operation, exclusive of labor		$ 32.51

*Allowing for interest earned by depreciation reserve.

Taking into consideration all facts as given, including the 25% increase in production, the savings effected by adding the new equipment are figured by the engineers as follows:

Saving in daily fixed charges and overhead expense on balance of plant and equipment:		
$85.00 × 25%		$ 21.25
Saving in labor:		
10 men × 10 hr. × $0.55	$55.00	
5 men × 10 hr. × .50	25.00	
1 man × $5.50	5.50	
1 man × 9.10	9.10	
	$94.60	
$94.60 × 25%		23.65
Saving in mud-capping (none now required):		
Dynamite—100 lb. × $0.1575	$15.75	
Fuse wire—150 ft. × $0.01	1.50	
Caps—100 × $0.015	1.50	
Labor	3.25	22.00
Total gross daily saving		$ 66.90
Cost of operating complete plant, excluding labor		32.51
Net daily saving		$ 34.39
Net saving per ton—$34.39 ÷ 500 tons		.0688
Net annual saving—$34.39 × 220 days		$7,565.80

Net annual return on total investment in complete primary crusher unit—19¾%.

Shovel loading piece of rock which almost fills car

Officers of U. S. Marine Corps placing test pans and slides

Fighting Malaria with Rock Dust

Hydrated Lime and Pulverized Stone Used to Kill Disease Bearing Insects

ROCK dust has already saved many lives by preventing coal dust explosions. Probably it might be proven that lime and powdered gypsum have saved many more by rendering those who breathe it immune to influenza and other pulmonary diseases. So rock products already play a considerable part in conserving the health of the public. Their latest use as a sanitary agent is in the prevention of malaria by killing malaria bearing mosquitos.

Tests were made recently by the U. S. Marine Corps on the Choppawansic marshes near Quantico, Va., where the marines have a camp. The marshes were dusted by an airplane with a mixture of paris green and ground soapstone which was used because it is produced in Virginia and could be obtained at a fairly low cost. Later experiments are being made with hydrated lime, and other rock dusts will be tried in turn. Hydrated lime, it has been pointed out, would have the advantage of destroying other troublesome insects such as flies and gnats.

It is the paris green, or more correctly the arsenical content of the paris green, that kills the mosquito larvae, but the rock dust is necessary. Only ½ lb. of paris green per acre is used, and to insure that this small quantity covers such an area it must be mixed with a very large quantity of some other powdered substance. The plane in the first test reported carried 300 lb. of the mixture of soapstone dust and paris green. As the dustings have to be repeated every 10 days, which is about the time it takes to breed a new crop of larvae, the amount of dust to be used, although small from a tonnage point of view, is a measurable amount.

Plane used for dusting the marshes

The tests were checked so that the effect of dusting could be definitely known. The method of checking was by exposing a number of pans in the path of the plane. In each pan were 10 *Anapheles* larvae and 10 *Culex* larvae. *Anapheles* is the family name of the malaria bearing mosquito. Glass slides covered with a sticky substance were also exposed so that the number of grains of paris green which fell on them could be counted. After the test a count of the larvae in the pans was made and 80% were found to have been killed.

Before trying this method of mosquito extermination the classical methods of draining the swamps and of covering the water with oil were considered. Draining could not be applied because parts of the area are below the level of the river. Covering such a large area with oil would be very expensive and it would kill off the fish, ducks and animals in which the marshes abound. Experiments have been made with oil soaked sawdust, however, in some small areas.

The method of killing mosquitos by dusting has been tried out in Louisiana with considerable success. It was natural it should be tried out in the south because airplane dusting of cotton fields to kill the boll weevil has been found effective there.

Plane flying over marshes near Quantico, Va.

Schumacher Plant Increases Capacity

EQUIPMENT for manufacturing plaster lath has been added to the Seattle plant of the Schumacher Wall Board Corp. at a cost of $25,000, J. E. Schumacher, president of the corporation, announced recently.

This product, which is used for backing interior plastering and exterior stucco, has been turned out at the plant in small volume heretofore, but demand has necessitated expansion of the facilities, Mr. Schumacher said. The new machine brings the investment of the Schumacher corporation at the Seattle plant to approximately $275,000.

"Showing the growth of the company's export trade, during the month of June 1,000,000 sq. ft. of plaster wall board was shipped from the Schumacher plant to New Zealand, Alaska and the Hawaiian Islands," Mr. Schumacher announced. "This total indicates an increase of 20% over May of this year, and a gain of 40% over the month of June, 1925."—*Seattle (Wash.) Times.*

Formulas for Proportioning Raw Materials in Cement Manufacture

Review of Many Investigations, and a Proposed New Formula Better Adapted to Modern Ideas

By Richard K. Meade
Consulting Chemical and Industrial Engineer, Baltimore, Md.

I HAVE read with much interest the article in the June 12 issue of ROCK PRODUCTS by Wm. A. Ernst and his assistant, E. A. Ernst, on the proportioning of cement raw materials. The value of this article is unquestioned and it is a great pity that chemists of long experience and training, such as these gentlemen have had, cannot be induced to write more often in technical publications of their methods. The wide experience of Mr. Ernst in the cement industry entitles anything which he may write to careful consideration and his methods for controlling a wet process mix are sound and well thought out. Such specific information is often hard to obtain and anyone who makes available such methods to the industry as a whole has done much to serve it.

Errors of Formulas Formerly Used

I am wondering, however, why those who write on the proportioning of cement materials quote and still employ the formulas devised by Michaelis, Newberry, Eckel and others. These formulas went along with steps in the development of our present knowledge of the composition of portland cement. They do not, however, any of them express the present generally accepted ideas as to the constitution of portland cement clinker. Why, therefore, do authors so well versed in the practical side of the question of cement manufacture employ Eckel's Index, for example?* This purports to be based on scientific knowledge of the composition of portland cement. As a matter of fact, it does not represent present day ideas. Such a formula may possibly satisfy the analysis of commercial cements, but this is a matter of chance rather than science.

It is strange that with the exception of the present writer, no chemists seem to have made any effort to correlate our present knowledge of the constitution of cement with a practical formula for proportioning raw materials, and so few chemists in this country seem to be able to apply the information placed at their disposal by the researches of Day, Shepherd, Rankin and Wright of the Geophysical Laboratory of the Carnegie Institute and Bates, Klein and Phillips of the U. S. Bureau of Standards. No work which has been done on the constitution of portland cement clinker compares with that which has been done by these institutions. The chemists of these laboratories not only brought to the problem fine technical training and wide experience in the solution of similar problems, but also had associated with them co-workers who were specialists in various allied fields to assist them in the solution of any minor problems which might arise during the progress of their work. They also had available the most delicate and precise apparatus. It is highly probable, therefore, that their ideas on the constitution of portland cement clinker are more nearly right than those of their predecessors. The investigations of the latter were largely those of single individuals, working with limited apparatus and a small staff of assistants, whose training, however excellent it may have been in the practical manufacture of cement, did not cover a sufficiently wide field (microscopic petrography, for example) to enable them to solve all of the minor phases of the problem.

In making this statement I do not wish to be understood as in any way detracting from the value of the work done by other investigators towards determining the chemical composition of portland cement. The man who set out for the North Pole on a dog sled, for example, had an infinitely harder task than one who sails there in an airship, and his effort, even if he did not reach the pole, might be very much the more creditable of the two. The work of Michaelis, Le Chatelier, Spencer B. and William B. Newberry will always be worthy of the highest praise and constituted steps in the actual solution of the problem.

I say solution of the problem. We must, however, remember that theoretically science is progressive and that we can only say that a problem is solved in relation to the present day theory. Facts remain fixed, but theories have changed with our increase of knowledge and no doubt will continue to change as time goes on and we know more.

Hydraulic Index and Lime Ratio

The German chemists who came to this country when the writer first became interested in cement manufacture, about 1896, brought with them for proportioning cement raw materials, a formula which has generally been credited to the elder Michaelis and which is based on the Hydraulic Index.[1] The terms "Hydraulic Index" and "Hydraulic Modulus" appeared frequently in the literature of cement prior to that time and were used to denote the ratio between the silica and alumina on the one hand and the lime on the other. This formula, neglecting ferric oxide and magnesia and expressed mathematically, was as follows:

$$\text{Hydraulic index} = \frac{\%\ \text{silica} + \%\ \text{alumina}}{\%\ \text{lime}}$$

Michaelis based his formula, as stated, on the hydraulic index and indeed it may be considered as the reciprocal of this, or the ratio between percentage of lime and the combined percentages of silica, alumina and ferric oxide present in portland cement. He states that this ratio must lie within the limits of 1 to 1.8 and 1 to 2.2. He proposed the empirical figure 2. His formula expressed as an equation is:

$$\frac{\%\ \text{lime}}{\%\ \text{silica} + \%\ \text{ferric oxide} + \%\ \text{alumina}} = A$$

A has a value of from 1.8 to 2.2 with 2 as a good working figure. Practically all normal American cements satisfy this formula. It was very evident, however, even in 1896 that a fixed ratio of 2 did not apply to all cases and also that this was probably often due as much to manufacturing conditions as to the composition of the raw materials. Of four cements analyzed by the writer, each from a different mill, and each representing about the average product at each respective plant, the ratios ranged from 1.92 to 2.18 and were as follows:

Mill A = 1.92
Mill B = 2.01
Mill C = 2.07
Mill D = 2.18

Any cement made at Mill D by this formula with a ratio of 2 would have been decidedly quick setting, while a cement made at Mill A with a ratio of 2 would have been unsound.

It early became evident that the fineness of grinding of the raw materials had much to do with how high a ratio could be carried

*Mr. Ernst has explained his reference to Eckel's Index in a supplementary note published in the July 10 issue, p. 55.

and also within certain narrow limits burning affected the ratio also. It will be noted that in the above formula magnesia is not considered and the relative percentages of silica, iron oxide and alumina are not taken into account. It is also evident to anyone who has studied chemistry and is familiar with the molecular or combining weights of various chemical compounds that the acid elements silica, alumina and ferric oxide (since their molecular weights are 60, 102 and 160 respectively) would not all be of equal value in satisfying the lime and furthermore it was generally believed that magnesia was in combination with the acid elements and therefore should be considered as lime.

In order to satisfy the above ratio of 2 where the cement is burned with pulverized coal, it is, of course, necessary to have the ratio in the raw materials somewhat above 2. Where the cement is burned with oil and there is hence no contamination of the former by the ash of the fuel it would undoubtedly be satisfactory to carry the ratio in the raw materials at the same figure as is desired in the cement.

It is evident that the Michaelis formula, or as we now know it, the "Lime Ratio" is purely *empirical* and is the result of *observation* and *experience* only. *It has no basis on theory.*

Le Chatelier's Formula

Le Chatelier[2] published his monograph on the composition of portland cement in 1887. In his dissertation, he propounded the theory that portland cement was composed of two essential compounds—tri-calcium silicate and tri-calcium aluminate. Le Chatelier was, I believe, the first chemist to apply to the study of the composition of portland cement methods similar to those which are employed in the study of rocks. This consisted in examining thin sections of cement clinker under the polarizing microscope.

Le Chatelier also made experiments upon the synthetic production of calcium silicates and aluminates by heating at high temperatures intimate mixtures of finely pulverized silica, alumina and lime in varying molecular proportions. He then examined into the hydraulic and microscopic properties of the compounds so prepared. It is noteworthy that Le Chatelier found that he could not prepare the tri-calcium silicate directly by heating lime and silica, the result of the attempt being a mixture of lower silicates and lime. It will be seen, therefore, that Le Chatelier could not directly observe the properties of tri-calcium silicate either under a microscope or when treated with water. As the result of his investigations, Le Chatelier assumed that three molecules of lime are united to one of silica to form the tri-calcium silicate and that three molecules of lime are united to one of alumina to form the tri-calcium aluminate. He, therefore, gives the following as the ratio between the lime and magnesia, the basic elements, and the silica, alumina and iron, the acid elements in a good cement:

$$\frac{CaO + MgO}{SiO_2 + Al_2O_3} \leqq 3 \qquad (1)$$

$$\frac{CaO + MgO}{SiO_2 - Al_2O_3 - Fe_2O_3} \leqq 3 \qquad (2)$$

Le Chatelier also states that No. 1 usually gives a good cement at 2.5 to 2.7 and No. 2 at 3.5 to 4. This formula is difficult to apply for the purpose of proportioning raw materials. Le Chatelier neither devised nor suggested an adaptation of it for such practical purposes.

Newberry's Formula

Some 10 years later, Messrs. Spencer B. and Wm. B. Newberry[3] repeated those experiments of Le Chatelier which covered attempts to produce hydraulic compounds by heating together mixtures of lime and silica and lime and alumina. They agreed with Le Chatelier that tri-calcium silicate was the essential compound but advanced the theory that the alumina was present as di-calcium aluminate. They prepared what they supposed to be silicates and aluminates of lime, essentially as did Le Chatelier, by heating together in a Fletcher gas-furnace intimate mixtures of finely pulverized quartz and calcium carbonate, and of alumina and calcium carbonate in different molecular proportions. They examined into the hardening and setting properties of the resulting compounds but made no microscopic study of the compounds which they prepared. Acting on the assumption that cement is composed of tri-calcium silicate and di-calcium aluminate, they proposed the following formula:

% lime = % silica × 2.8 + % alumina × 1.1

The Newberrys made an error in common with all earlier investigators in assuming that the preparation of a compound which was "sound" or "volume constant" was proof that this compound existed in cement, and conversely that if the material was unsound it did not exist in cement. The fallacy of this is evident to those who have made a study of the action of various compounds of lime, silica and alumina with water. This error led the Newberrys to the wrong conclusion that alumina was present in cement as di-calcium aluminate. In the light of later investigations it is also very doubtful if they prepared tri-calcium silicate and that the material they so called was merely a fused mixture of di-calcium silicate and free lime.

It was evident that cement proportioned according to Newberry's formula would be unsound. Those who stood sponsor for the formula, however, reasoned that under ideal conditions as to grinding and burning the formula would hold good, but under manufacturing conditions it was necessary to carry the lime a little lower than that called for by the formula.

Later investigations have shown the error in the assumption that all the lime is present as tri-calcium silicate and the alumina as di-calcium aluminate upon which the Newberrys formula was based. It is quite probable that had the Newberrys made a microscopic study of thin sections of the compounds which they prepared they would have found their errors.

We may pass over the investigations of Toernebohm, the Swedish investigator, and of Richardson, in this country, as these influenced in no way the formulas generally used in proportioning cement mixtures. Eckel's efforts seem to have been largely confined to elaborating Newberry's formula and his "cementation index" is mere scientific jargon based on no experimental work.

Work of the Geophysical Laboratory of the Carnegie Institute

The Carnegie Institute began some 20 years ago its investigation as to the constitution of portland cement clinker. The first paper from this institution was published in 1906 by Day and Shepherd.[4] These authors stated that they had been unable to prepare tri-calcium silicate directly by simply heating a mixture of silica and lime together and proved conclusively that the compounds so-called as prepared by others were merely mixtures of lime and calcium di-silicate.

At a little later date, however, Dr. Shepherd, who had associated with him in this investigation Dr. Rankin, found that by prolonged heating at a temperature somewhat below 1900 deg. C. they could prepare tri-calcium silicate from a mixture of finely divided oxides in proper proportions. They also found that if a small amount of alumina was present the combination is more rapid, takes place at a lower temperature, etc. This work was then followed up by a very thorough investigation of cement clinker in which Rankin, Bates, Klein, Phillips, Wright and other chemists of the above laboratory took part. A thorough study of the silicates was made and their optical characteristics were measured carefully. As the result of this study of all the compounds likely to occur in clinker they were able to identify five compounds in this. These compounds are:

TABLE I.—COMPOUNDS FOUND IN CEMENT

	Per cent
Lime, CaO	
Lime	100
Di-calcium silicate, $2CaO \cdot SiO_2$	
Lime	65.0
Silica	35.0
Tri-calcium silicate, $3CaO \cdot SiO_2$	
Lime	73.6
Silica	26.4
Penta-calcium tri-aluminate $5CaO \cdot 3Al_2O_3$	
Lime	47.8
Alumina	52.2
Tri-calcium aluminate, $3CaO \cdot Al_2O_3$	
Lime	62.2
Alumina	37.8

Dr. Rankin,[5] who did most of the later work at the Geophysical Laboratory on the composition of portland cement clinker, states that the essential compounds of portland cement are the *tri-calcium silicate*, the *di-calcium silicate* and the *tri-calcium alumi-*

nate and outlines the following as the method by which clinker is formed.

Formation of Cement Clinker

Neglecting minor reactions, when a properly proportioned mixture of raw materials is heated, the first change is the liberation of the carbon dioxide and the formation of lime; the lime then unites with the two other components silica and alumina to produce the compounds which form most readily, $5CaO{\cdot}3Al_2O_3$ and $2CaO{\cdot}SiO_2$; probably in the order given, since the former melts at a lower temperature than the latter. These two compounds next unite in part with more lime and the compounds $3CaO{\cdot}SiO_2$ and $3CaO{\cdot}Al_2O_3$ appear. The formation of the last two compounds would go on very slowly in mixtures of these two compounds only, but is materially facilitated by the fact that a portion of the charge has already melted and promotes reaction by acting as a flux or solvent. This fluxing action is increased by the presence of the iron oxide and the alkalies, always present in commercial cements, which lower still further the melting point of the solvent.

The temperature at which this flux first appears with pure materials is 1355 deg. C., the eutectic temperature for the three compounds, $2CaO{\cdot}SiO_2$, $5CaO.3Al_2O$, $3CaO{\cdot}Al_2O_3$, but with commercial mixtures is undoubtedly much lower. As the temperature of burning gradually rises, the relative amount of flux increases and the rate of formation of $3CaO{\cdot}Al_2O_3$ and $3CaO{\cdot}SiO_2$ increases correspondingly. At a temperature which with pure materials is above 1355 deg. C., but where iron oxide and the alkalies are present is undoubtedly somewhat lower, the compound $5CaO{\cdot}3Al_2O_3$ will have completely melted in the flux and the formation of the compound $3CaO{\cdot}Al_2O_3$ will be completed. The substances present as crystals at this stage are $3CaO{\cdot}SiO_2$, $2CaO{\cdot}SiO_2$, $3CaO{\cdot}Al_2O_3$ and free CaO.

If the burning were stopped at this stage, the cement would be "unsound," due to the free lime. If the heating is continued, the $3CaO{\cdot}SiO_2$ rapidly increases in amount, due to combination of $2CaO{\cdot}SiO_2$ with CaO, while the amount of solid $2CaO{\cdot}SiO_2$, CaO and $3CaO{\cdot}Al_2O_3$ are all decreasing the $2CaO{\cdot}SiO_2$ partially by combination with CaO and partially by dissolving along with $3CaO{\cdot}Al_2O_3$ in the flux. With pure materials at a temperature of about 1475 deg. C., the $3CaO{\cdot}Al_2O_3$ will all have dissolved in the flux and most of the CaO will have combined with $2CaO{\cdot}SiO_2$ to form $3CaO{\cdot}SiO_2$, so that the crystalline substances now present in the flux are $3CaO{\cdot}SiO_2$, $2CaO{\cdot}SiO_2$ and a trace of CaO. As the temperature is raised still further, each of these crystalline compounds will gradually disappear and, if such a charge is cooled, the final product of crystallization will consist largely of $3CaO{\cdot}SiO_2$, $2CaO{\cdot}SiO_2$ and $3CaO{\cdot}Al_2O_3$.

In cement burning, the temperature is never carried to that necessary to fuse or flux the entire mass. Rankin states that with white cement good results are obtained with 30% melted and 70% solid crystalline material.

Hydraulic Properties of the Silicates and Aluminate of Lime

Following up the work of Rankin, Bates and Phillips[6] investigated the properties of various compounds existing in cement when treated with water, both alone and in mixtures. Their work consisted of the preparation of the pure compounds themselves and also in burning cements of certain definite compositions, corresponding respectively to a low lime-high silica clinker, a normal clinker and a high lime-low silica clinker.

Their investigations show that the important elements of cement so far as the hardening goes are the tri-calcium silicate and the di-calcium silicate and that alumina compounds are needed only as a flux and are of themselves of doubtful value aside from this.

According to this investigation, tri-calcium aluminate hydrates almost immediately on adding water, with the evolution of so much heat that the mixture boils. This compound makes a very plastic mass which may be wetted and worked up again after it has apparently set. It gains practically all its strength within 24 hours, but is too weak and sets too rapidly to be of commercial use by itself.

Di-calcium silicate has apparently no setting properties in the ordinary sense of the word, but it does hydrate very slowly. At early periods, the compound has hardly any strength. Bates attributes the slow hardening of cements at periods beyond 28 days to the action of this compound and states that it then becomes equal to tri-calcium silicate in strength. Di-calcium silicate, however, sets and hardens too slowly for commercial use alone.

Tri-calcium silicate has all the properties of cement except a slightly inferior plasticity. At early periods (seven days) it is the strongest of the three compounds. The addition of 3% of gypsum to tri-calcium silicate gives it plasticity and quickens its set. Tri-calcium silicate gains its full strength before seven days.

The addition of tri-calcium aluminate to tri-calcium silicate increases its plasticity but decreases its strength. The mixture gives off heat and is quicker setting than the tri-calcium silicate alone. If plaster is added to the mixture of the two compounds, it reduces the amount of heat evolved and slows the initial set.

A mixture of tri-calcium silicate and di-calcium silicate resembles cement except that it works more sandy. The addition of tri-calcium aluminate gives the mixture a flash set, heat being evolved, but increases the plasticity. If plaster is added to the three compounds it reduces the heat evolved, increases the initial set, reduces the final set and makes a more plastic mortar. From their investigation of various mixtures of the three compounds referred to above these scientists stated as their opinion that the composition of cement should be along lines which would not produce a preponderance of either the di-calcium or tri-calcium silicate. In other words, that the two silicates should be present in the clinker in *about equal amounts*. This would give a not too dense hydrated material gaining strength at later periods.

Practically all investigators of the composition of portland cement seem to agree that iron may replace alumina in molecular proportions to form the tri-calcium ferrate.[7] Bates,[8] Klein and Phillips[9] made a very careful study of the properties of cements containing high percentages of magnesia and they concluded that magnesia up to about 9% would form compounds similar to those of lime.

At the end of this article I have given references to various papers in which are found the conclusions of the above investigators so that those who are interested may refer to them.

Formula Based on Bates and Rankin's Work

The author[10] suggests the following method of arriving at a scientific formula for expressing the correct relation between the various elements in cement:

Summing up the later theories as to the constitution of cement clinker, it will be recalled that Rankin found the essential compounds in cement to be the di-calcium silicate, the tri-calcium silicate and the tri-calcium aluminate. Bates considers that the two silicates should be present in about equal proportions. These chemists also concluded that magnesia replaces lime, and iron oxide combines as alumina.

It becomes quite evident from the above, therefore, that the composition of cement clinker lies between (1) a mixture of di-calcium silicate and tri-calcium aluminate and (2) a mixture of tri-calcium silicate and tri-calcium aluminate; or expressed mathematically and neglecting other elements such as magnesia and iron oxide (refer to Table II for relation between the various elements):

(*I*) Lime = 1.85 × silica + 1.65 × alumina

(*II*) Lime = 2.8 × silica + 1.65 × alumina

These two formulas, of course, represent the extremes and we know that *I* would give a cement too low in lime to be of any use, while *II* certainly under existing processes of manufacture would give one too high in lime to be sound. The correct composition, therefore, lies between these two formulas. Bates' experiments are borne out by microscopical analyses of the clinker and are also checked by the relations between the lime and the silica and alumina as shown by analysis. For the present, therefore, the two

silicates may be assumed desirable in about equal amounts.

In a mixture of equal parts of di-calcium silicate and tri-calcium silicate, the relation between the lime and silica will be (refer to Table I):

$$\frac{\text{Lime}}{\text{Silica}} = \frac{65 + 73.6}{35 + 26.4} = \frac{138.6}{61.4}$$

Or

$$\text{Lime} = 2.3 \text{ Silica.}$$

TABLE II.—RELATION BETWEEN VARIOUS COMPOUNDS IN CEMENT

Silica×2.8=lime combined as tri-calcium silicate.
Silica×1.9=lime combined as di-calcium silicate.
Alumina×1.7=alumina combined as tri-calcium aluminate.
Iron oxide×0.6 equivalent to alumina.
Magnesia×1.4 equivalent to lime.
Sulphur trioxide×0.7 equivalent to lime combined as calcium sulphate.

If the two silicates are to be present in about equal proportions, the formula for a three element cement would then be:

Silica × 2.3 + alumina × 1.7 = lime

Or referring to Table II and taking the iron oxide, magnesia and sulphur trioxide into consideration:

Silica×2.3+(alumina+iron oxide×0.6)×1.7 =lime+magnesia×1.4—sulphur trioxide×0.7

This formula may be somewhat simplified as follows:

Silica×2.3+alumina×1.7+iron oxide =lime+magnesia×1.4—sulphur trioxide×0.7

The analyses below give examples of cements which satisfy this formula.

	A Per cent	B Per cent	C Per cent
Silica	22.0	19.4	23.0
Alumina	7.5	9.2	5.4
Iron oxide	2.5	4.1	3.1
Lime	62.6	63.1	63.8
Magnesia	2.5	1.6	1.7
Sulphur trioxide	1.5	1.2	1.5
Loss on ignition, etc...	1.5	1.4	1.5

Proportioning by Formula

This formula may be used for proportioning the raw materials. The method of doing this can be best explained by an example. Let us suppose we wish to make a mix of clay and limestone of the following composition:

	Clay Per cent	Limestone Per cent
Silica	63.0	2.0
Alumina	20.0	0.8
Iron oxide	7.0	0.5
Lime	1.0	53.0
Magnesia	1.0	1.0
Loss on ignition, etc.	8.0	42.7
LIMESTONE		
Lime	53.0	
Magnesia 1×1.4=	1.4	
		54.4
Silica 2×2.3=	4.6	
Alumina 0.8×1.7=	1.4	
Iron oxide	0.5	
		6.5
Available lime		47.9
CLAY		
Silica 63×2.3=	144.9	
Alumina 20×1.7=	34.0	
Iron oxide	7.0	
		185.9
Lime	1.0	
Magnesia 1×1.4=	1.4	
		2.4
Required lime for 100 parts		183.5

The number of parts of limestone required for 100 parts of clay will then be

$$\frac{183.5 \times 100}{47.9} = 383.$$

Or the mix should consist of

Clay	21%
Limestone	79

If burned with oil, this will give a cement in which the relation between the lime and silica and alumina will be satisfactory. If burned with coal, the ash of the latter will disturb the balance and make the cement overclayed. Allowance should, therefore, be made for the ash. The simplest method will be to consider the ash as clay and reduce the latter in the mix to correspond with the percentage of ash in the fuel, etc.

For example: Six hundred pounds of mix will consist of 126 lb. of clay and 474 lb. of limestone. About one-half the coal ash enters the clinker. If the coal has 12% ash and 100 lb. of coal are required to burn a barrel of cement, then 6 lb. of ash enter the clinker, and deducting this amount of clay our percentages would be:

Clay	20%
Limestone	80

If the clay and limestone are mixed in the proportions indicated above, the "composition" would have the following analysis:

Silica	14.20%
Alumina	4.64
Iron oxide	1.80
Lime	42.60
Magnesia	1.00
Carbon dioxide, etc.	35.76

It is interesting to note that in the above the "lime ratio" is 2.05.

All of the older formulas were based on the assumption that portland cement is a definite compound; whereas in reality it is a mixture. If cement were simply a mixture of tri-calcium silicate and tri-calcium aluminate, it would be very easy to work out a formula which would satisfy such a composition. The problem, however, is not so simple. In our present state of the art, we are unable to say just what proportions of tri-calcium silicate and di-calcium silicate are most desirable. We do know, however, that in commercial cements taken as an average the two are in about equal proportions.

At the same time, the variation in the relative amounts of tri-calcium silicate and di-calcium silicate allowable are evidently quite wide. The analyses given below represent about the extremes and the mean for the product of one mill during one year:

	Low lime	High lime	Average for year
Silica	22.86	21.14	22.10
Alumina	7.52	6.94	7.32
Iron oxide	2.50	2.30	2.45
Lime	61.02	63.24	62.01
Magnesia	3.05	3.26	2.92
Sulphur trioxide	1.56	1.20	1.36

Both the low lime and high lime cement gave very satisfactory tests, the latter, however, being much the stronger. Considering magnesia as lime and iron oxide as alumina in the relations given in Table II, the proportions of di-calcium silicate and tri-calcium silicate in the three cements represented by the above analyses are:

	Low lime	High lime	Average for year
Di-calcium silicate	73	32	48
Tri-calcium silicate	27	68	52

It will be noted that the average agrees very closely with the formula suggested. It will also be noted that if 2.5 be substituted for 2.3 in the suggested formula that the high lime cement will comply with this. Where a greater percentage of tri-calcium silicate is desired, 2.4 or 2.5 may be substituted for 2.3 in the formula, according to the desires of the chemist, etc.

If the tri-calcium silicate is present in too small a quantity, the cement lacks plasticity and will be quick setting. If present in too large quantity the cement has high early strength, with a tendency to fall off at later periods. It is quite possible, however, that methods could be devised which would overcome this tendency and which would allow practically all the silica to be present in cement as tri-calcium silicate. This would probably increase very materially the early strength of the cement. The manufacture of cement having a very high percentage of tri-calcium silicate could unquestionably be brought about, if desirable, by finer grinding of the raw materials coupled with longer time in the kiln and possibly an increase in the temperature of burning. Under existing conditions, however, and with no experience as to the behavior of high lime cements in long-time tests, and with the improvements which have been made in grinding machinery, it would seem better policy to obtain greater strength by *finer grinding of the cement itself* rather than the more expensive process of grinding raw material finer and burning longer and at higher temperatures.

In making up formulas, therefore, which express the composition of cement in the light of modern research, we must take into consideration the relative percentages of di-calcium silicate and tri-calcium silicate desired in the cement. Some chemists will no doubt feel that the formula which the writer suggests above will give too high a percentage of lime, while others may prefer to increase the amount of tri-calcium silicate and consequently the lime. It is a fact, however, that the formula which has been suggested above satisfied a very large number of portland cements which have come under observation. It must be remembered, however, that it presumes a cement in which the two silicates are in equal proportions; whereas, as shown above, cement may vary considerably from this.

References

1. Michaelis, *Cement and Engineering News*, August, 1900.
2. Le Chatelier, *Ann. des Mines*, 1887, p. 345. Also "Constitution of Hydraulic Mortars," J. L. Mack, translator.
3. S. B. and W. B. Newberry, *J. Soc. Chemical Industry*, Vol. XI, p. 1035.
4. Day and Shepherd, *J. Am. Chem. Soc.*, Vol. XXVIII, p. 1089; also Shepherd and Rankin, *J. Ind. and Eng. Chem.*, III, 225.
5. Rankin, *Am. J. Science*, 1915, Vol. XXXIX, p. 1.
   Rankin, *J. Franklin Inst.*, 1916, p. 747.
   Rankin, *J. Ind. and Eng. Chem.*, 1915, Vol. VII, p. 466.
6. Bates and Phillips, Tech. Paper No. 78, U. S. Bur. Standards.
   Klein and Phillips, Tech. Paper No. 43, U. S. Bur. Standards.
7. Hilpert and Kohlmeyer, *Ber. deut. Chem. Ges.*, Vol. XLII, 4581, also *Metallurgie*, Vol. VII (1910), 193, 225.
8. Bates, *Concrete-Cement Age*, 1914, p. 29; also *Proc. Am. Concrete Inst.*, 1914.
9. Klein and Phillips, *8th Int. Congr. App. Chem.*, V, 81.
10. Meade, "Portland Cement," 3rd Ed., p. 78.

Current Abstracts of Foreign Literature

Sulphuric Acid from Gypsum.—Gypsum as a raw material in the manufacture of sulphuric acid is not a new idea, but the first really commercial process has been only recently developed by the Bayer Co. in Germany. The gypsum is decomposed in admixture with carbon to give lime, sulphur dioxide and carbon monoxide. Aluminous substances are also added in such amounts that the residue after the roasting of the mixture closely resembles the normal mixture used in the production of portland cement.

The following conditions were developed for the successful operation of the process. In the first place the mixture must be dry when brought into the furnace in order to obtain a sufficient degree of sulphur dioxide concentration. Then the gases of the furnace must be weakly oxidizing, since if the atmosphere be at all on the reducing side, carbon oxysulphide will be present in the gases evolved and calcium sulphide will be found in the clinker residue. Further the amount of carbon in the mixture as indicated in the equation of reaction is too great for satisfactory working in a large furnace, the temperature and general behavior of which can be kept under exact control, for too great a degree of reduction takes place and calcium sulphide is formed and this causes the residue to fuse instead of sintering, with consequent damage to the furnace material.

It was developed that the best conditions for operating the furnace were to use half the theoretical amount of carbon and a slight excess of oxygen in the furnace gases. With these conditions the sulphur dioxide was obtained in a satisfactory degree of concentration and purity, the reaction went smoothly and the residue was obtained as a satisfactory clinker. If the amount of carbon is reduced below that specified, then considerable amounts of undecomposed gypsum are left in the mixture. This gypsum lowers the fusion point of the residue and generally leads to trouble all around.

This process has been patented in German Patent No. 200,849, and a large plant is now operating in Germany with a capacity of 200 tons of mixture per day.

Clay slate or argillite is employed in the place of clay. This is coarsely broken up and passed through a drying drum to a silo. For carbon, coke is used and this material also, after being reduced in a roller breaker and dried by passage through a drum, is conveyed to a storage silo. The gypsum material is ground in a cone mill. Calcium sulphate as precipitated sulphate obtained from chemical manufacturing processes as a waste product is first dried and then ground in a ball mill. The determined portions of clay, slate, coke and gypsum are then intimately mixed and given a final grinding in a ball mill. The mixture thus obtained passes over a wind sifter to the main storage silo, and from here to a second silo in quantities just sufficient for a furnace charge.

The rotary kilns are fired with pulverized coal and a complete coal drying and grinding plant is part of the Bayer installation at Leverkusen. The burnt clinker in the furnaces after the operation has been completed, is automatically conveyed to a clinker storage, whence it is mixed with ground slag and worked up to a blast furnace cement. A proportion of ground gypsum is added to this cement mixture to give it the requisite bond. The whole of the production and the bagging of the cement is carried out automatically and in a dust removing plant provided with Beth filters.

The gases which leave the revolving furnaces contain about 6% to 7% of sulphur dioxide, and are freed from dust by electrical precipitation after which they pass through a washing apparatus and on to the sulphuric acid plant, which is either a contact plant or a Schmiedel intensive chamber plant. The cement that is obtained from the clinker resulting from the process is of very good quality and detailed figures are given on this point in the original article. It is also indicated that the cost of manufacturing cement by this process is no greater than by the ordinary way utilizing marl or limestone.—*Zeitschrift fuer angewandte Chemie* (1926) **169-174.**

Induration or Mineralization of Organic Matter.—Fibrous organic matter, either moistened, or washed with a weak solution of an alkali or of an acid, is treated with a dry hygroscopic chemical which reacts exothermically with water, such as dry caustic soda preferably in flake form, or dry caustic lime, or magnesium chloride, and mixed, while heat is still being evolved, with cement, mortar or the like to produce on setting a light form of concrete which can be molded under pressure.—*British Patent No.* 249,899.

Cement from Over-burnt Gypsum or Anhydrite.—Cements are manufactured from over-burnt gypsum, over-burnt gypsum waste or natural anhydrite by a process which does not involve the use of any simultaneous or subsequent heat treatment, by mixing the raw material intimately with the appropriate amount of acid alkali sulphate, for example sodium hydrogen sulphate, or potassium hydrogen sulphate, or neutral alkali salt together with the requisite amount of sulphuric acid.—*German Patent No.* 320,957.

New Super-Cement—A new supercement, known as "Novo-Zement," has been manufactured in Germany. It possesses an hydraulic modulus of 2.32 and a silicate modulus of 2.64, and when mixed in normal proportions, it attains a 24 hr. strength of 396 kg. per sq. cm. Its degree of fineness is as follows: zero per cent residuals, or 3.3% or 10.1%, respectively, over 900, 4900 and 10,000 mesh sieves.—*Beton and Eisen,* (45) **149-150.**

Waterproof Concrete Mixture.—A colloidal solution of wax, preferably paraffin wax, is mixed with the ingredients of concrete, artificial stone, or mortar for waterproofing purposes. It may also be applied as a coating to existing work.—*British Patent No.* 250,652.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Superintendent of Documents, Government Printing Office, Washington, for each patent desired.

Recovering Calcium Carbonate from Waste Liquors of Paper Manufacture. The tank liquor is treated with about 5 to 10% of the lime necessary to causticize it and the precipitated $CaCO_3$ carries with it the greater part of the impurities. The filtered solution is then treated with the required amount of lime and the resulting precipitated calcium carbonate after filtering and drying is of light color, free from grit, finely divided and available as a filler for rubber compounds. *U. S. Patent No.* 1,587,679.

Hydrated Lime Manufacture. Quicklime is slaked in excess of water to a flowing putty and large portion of water is removed before slaking is completed. The slaking is then allowed to continue to completion with the remaining water and the heat thus generated used to evaporate excess water. *U. S. Patent No.* 1,580,710.

Apparatus for Manufacture of Superphosphate. A design of plant wherein the acid and rock phosphate are weighed separately and delivered into a mixer from which the resulting mixture is discharged into a disintegrating device arranged to deliver to storage or when required for additional treatment before storing. *U. S. Patent No.* 1,585,810.

Colored Granulated Slag. Copper slags are treated with varying amounts of lime or limestone, then smelted in furnace until the iron content is low and finally the molten mass is poured into water. *U. S. Patent No.* 1,582,318.

Cement Roasting Apparatus. Suitable apparatus for cement making process in which low temperature treatment of raw cement material is followed by high temperature treatment in a separate rotary kiln. A heat recovery apparatus is combined with the sectional kiln and a means provided of dividing the waste gases from the high temperature kiln and allowing only a determined amount to enter the low temperature kiln. *U. S. Patent No.* 1,582,831.

Breaking Out Rock with Explosive Projectiles. Percussion shells loaded with explosive are projected against rock formations from a gun operated by compressed air. The method and apparatus applies particularly to the formation of **kerfs** and springing of drill holes. *U. S. Patent No.* 1,585,664.

Service Study of a Welded Kiln

Reduction of Shell Thickness Recommended as a Result of This Investigation

A CAREFUL study was recently made of a rotary lime kiln manufactured about three years ago by the oxwelding process. This kiln was one of a battery of three installed in a new plant, so that it could be studied not only individually but also in comparison with riveted kilns put into service at the same time.

The kiln is 125 ft. long and 8 ft. in diameter. Riveted kilns of this size have usually been made of 5/8-in. plate, with butt strap joints, double riveted on longitudinal seam and triple riveted on circumferential seams. A theoretical analysis of the stresses of such a kiln when in operation under full load indicates that the greatest forces existing in the steel plate are about 4700 lb. per sq. in., which is only 30% of the safe design load for structural steel in buildings. Undoubtedly the metal in such a design is not working to anywhere near its capacity, but since experience indicates that riveted kilns should be made of 5/8-in. plate, the welded kiln was also made of the same thickness. The joint, however, is extremely simple, as shown in Fig. 1.

Certain definite advantages were hoped from the welded construction. Owing to the unprecedented size of the equipment, the welding did not progress with the expected speed, and the final cost of the welded shell was somewhat greater than its riveted twin. It, however, was closer to line and shape—it was off dimension at the ends ½ in. and ⅜ in. respectively, whereas the tolerance was 5/8 in. It also required less labor to install the lining.

In order to gain a further insight into the operations of these kilns, and to determine if possible the reason for such a large excess of metal required in the shell, the Linde Air Products Co. sent a testing engineer to the plant to make a study of the installation and prepare a detailed report on it from which this is taken.

A series of determinations of the internal stresses were made by means of an extensometer. Having measured these small stretches, it is easy to compute the loads which cause them.

Fig. 2 shows a diagram of the results of tests on the oxwelded kiln running empty. The vertical scale of the sketch has been much magnified, so the kiln appears to be several times as large in diameter in comparison to its length as it actually is. The horizontal straight line, 0-0, represents no stress, and the distance from this line vertically to the curved line represents the amount of stress in the shell at the corresponding distance from the end. It will at once be recognized that the kiln acts as a long beam, overhanging its two supports. At the very ends the stress will be zero; the stress in the steel gradually increases until it reaches a maximum at the supports.

From the supports toward the center, the compressive stress (in the bottom, for instance) quickly decreases and at the center of the span increases to a maximum tension. Stresses in the top of the shell, of course, are exactly opposite, tension where the diagram shows compression, and vice versa. As the kiln rotates, these stresses continually

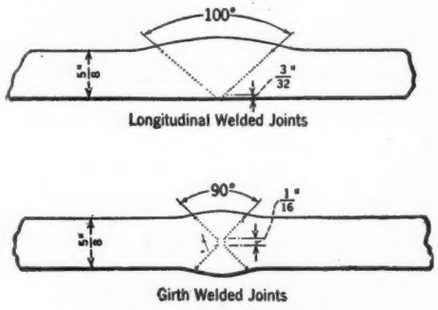


Fig. 1—Joints in welded kiln

change, what was at one moment the top of the shell soon becomes the very bottom, and then back again, reversing the loading twice every rotation. Such continually changing load is most severe treatment to withstand.

It was estimated that the shell, plus the lining, weighs 360,000 lb. Despite this enormous weight, the stress in the shell is maximum at the center of the span and at the upper support, and may easily be computed to be 3,000 lb. per sq. in. A series of actual extensometer measurements, plotted in the dotted line in the diagram, shows that the theoretical values are only a trifle too high.

Measurements made across the joints in the welded kiln showed no undue movement. In other words, the oxwelded joint acted as a homogeneous portion of the shell. Similar measurements across triple-riveted butt straps in the riveted kilns, however, showed movements from 2 to 2⅓ times the amount existing in the plates immediately alongside. This excess movement is undoubtedly due to a slipping of the sheets in and out, every time the kiln rolls over. It cannot be laid to poor or loose riveting, as the work was done in a modern shop with hydraulic machinery, under the closest supervision and inspection. It is undoubtedly an inherent action in a riveted joint, observed in hundreds of other structures, where unequal distribution of alternate loading on the rivets causes progressive loosening of the joints. Users of riveted kilns expect to shut down before many years, rip out the lining, and redrive a lot of loose rivets. Apparently this need not be expected in welded construction.

Similar tests were made with the kiln containing its normal load of 45,000 lb. of limestone. This increased the maximum stress in the shell to about 4,000 lb. per sq. in. The maximum possible loading is shown in Fig. 3, when a heavy collar of material has sintered against the shell near the hot end. Even under these conditions the maximum stress in a welded shell is about 4,700 lb. per sq. in. However, after only 2½ years of operation, the riveted joints would show movements under the same loading equivalent to a unit stress of 2⅓ times as great, or 11,000 lb. This is approaching much closer the safe limit for a steel structure.

The engineer points out that the investigation thus shows why a riveted kiln must be made of such heavy plate. If it were not it would quickly work itself to pieces. The investigation also shows another important fact not known three years ago when the oxwelded kiln was made. That is, that there is no reason why a welded shell should be as thick as a riveted shell. Large savings in construction costs are thus made possible at the outset.

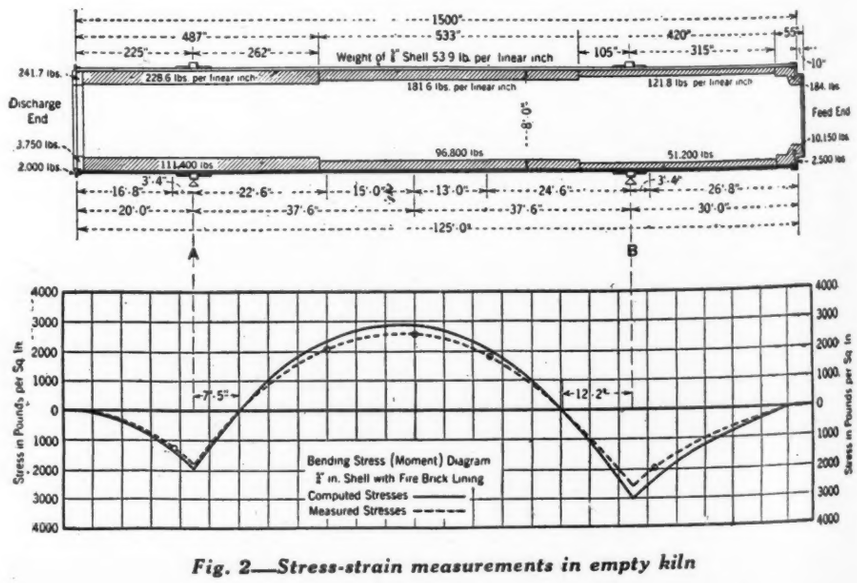


Fig. 2—Stress-strain measurements in empty kiln

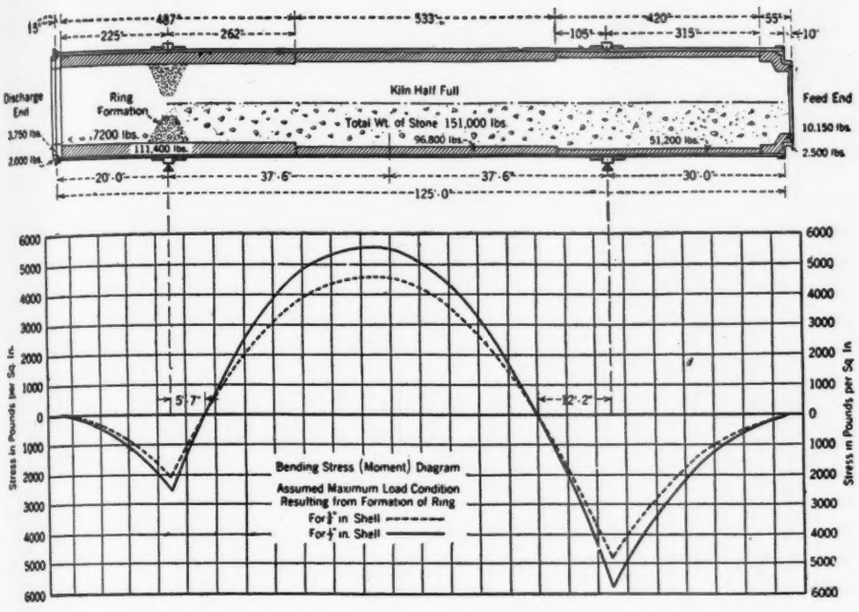

Kiln Half Full
Total Wt. of Stone 151,000 lbs.
Ring Formation
Discharge End
Feed End
Bending Stress (Moment) Diagram
Assumed Maximum Load Condition Resulting from Formation of Ring
For ⅝" in. Shell
For ½" in. Shell
Stress in Pounds per Sq. In.

Fig. 3—Stress-strain diagram under conditions of maximum loading

For instance, the dotted line in Fig. 3 indicates that the maximum possible stress in an oxwelded kiln of this size made of ½-in. plate would be only 5,600 lb. per sq. in. For this loading, seldom if ever reached, the factor of safety is 6.4, based on the elastic limit (or 8, if based on the ultimate strength after allowing a joint efficiency of 80%). These factors will appeal to designers as extremely conservative. Maximum shearing stresses do not exceed 1,100 lb. per sq. in.; temperatures never run much more than 400 deg. F., and dynamic stresses are negligible.

The engineer making the report suggests that by reducing the shell from ⅝ in. to ½ in., a marked saving can be effected, thus reducing the cost far below that of riveted construction. In addition to saving 8 tons of steel in a kiln of the size tested, there would be a material saving in bending, handling, freight and erection. The cost of welding also drops very rapidly with decrease in plate thickness.

Aggregate for Caen Stone

THE commercial product of Caen stone of today is manufactured by adding a cementitious material to a graded aggregate.

The cementitious material should permit of being soaked in water and allowed to stand a day before using and the aggregate should not contain any dust or grains larger than what would pass a 20 mesh screen, and yet the aggregate should be composed of several sizes so as to allow the use of the least amount of cementitious material possible.

When the voids are properly filled the commercial Caen stone will not shrink, and when applied to a proper base and allowed to stand until thoroughly dry, will be in condition to surface with proper tools.—*Construction.*

Deposits of Fluospar at Papiol, Spain

UP to the present time the importation, exportation, production and consumption of fluorspar in Spain have been neglible and the Spanish customs publications have not included statistics of either imports or exports. Production, as recorded in the Estadistica Minera de Espana for 1924 (the latest issue), was limited to a total of 634 metric tons (mined) and 1200 cubic meters (quarried), with a value at mine or quarry of 41,526 pesetas. (The peseta = $0.1334 at average exchange for 1924.)

The small production recorded was from a mine in Guipuzcoa Province, as a by-product from lead mining, and at an open quarry in Oviedo. There are undoubtedly a number of other deposits in Spain, especially in the provinces of Huesca, Cuidad Real, and Cordoba, but most of these, with the exception of the deposit in Barcelona Province, contain impurities and are geographically too remote for profitable exploration.

The Berta mine is located at Papiol, Province of Barcelona, only about 12 miles distant from the port. Originally equipped for the mining of lead, it was recently reopened for the purpose of extracting fluorspar. Seven discovered veins have a thickness of 2 meters, length of 600, and depth of 200, and actual deposits of 5,000,000 tons. The latest workings show prolonged veins and unexpected thickness, and it is believed that the quantity of ore available is much greater than estimated. Six horizontal galleries have been constructed, having a total length, with branches, of more than 3 miles. With the present installation, the owners estimate that 5000 to 6000 tons of fluorspar can be extracted monthly. The crushing mill has a capacity of 450 tons per day of 24 hours.

The native ore is sometimes accompanied by lead. Usually, a more or less complete separation can be made by selection. In other cases the ore is coarsely ground and the lead and fluorspar are separated by washing. The proportion of lead varies greatly in different parts of the mine. The principal lead-bearin gveins are in the lower galleries, which are flooded with water.

The fluorspar found in the Berta mine is usually of a greenish color, semitransparent, and containing on an average of 94% and 98% of calcium fluoride. Silica varies from 0.15% to 4% and sulphur is limited to a very small amount. There are small quantities of carbonate of lime, oxide of iron, and alumina in the form of silicate. Analyses of two samples in September, 1924, showed 98.6% calcium fluoride for the green color and 94.4% for the white rose. Judged by commercial standards, therefore, the ore appears very pure, free of injurious substances with the possible exception of lead.

So far the Spanish consumption of fluorspar has been very small, and although it promises to increase, it will probably not be sufficient to support even a single mining enterprise for some years. The glass industry requires a few tons annually, the iron and steel industry at Sagunto at present uses about 100 tons a month, and it is thought that there is a potential demand for the copper activities of Huelva Province and iron and steel production at Bilbao. At the best, however, domestic demand is not likely to exceed a few hundred tons monthly for a long time. The present cost to the user ranges from 100 to 150 pesetas per ton.—Consul Frank A. Henry in *Commerce Reports.*

Japanese Tests on Calcium Chloride in Concrete

A REPORT issued by the Higher Technical School of Sendai, Japan, gives the result of tests on the use of calcium chloride in concrete made in the cement research laboratory of the school. Tests were made on a 1-3 mortar, the sand being graded from 0.0027 to 2.29 mm., which is much finer than is used in American practice. The report is excellently written and graphs and tables show the results obtained very clearly. Three water-cement ratios were used, the water being 9%, 10% and 11% of the weight of the cement.

The conclusions drawn by the author, Shichiro Uchida, agree fairly well with what is known of the use of calcium chloride in concrete in this country. It was found that no advantage was gained by using more than 2% to 3% of calcium chloride, figuring from the weight of the cement. Beyond a critical percentage a reduction in strength followed. The addition of 3% of calcium chloride accelerated the hardening time materially. One table shows that practically the same strength was obtained in 14 days by the use of calcium chloride as was obtained in 28 days without its use.

Hints and Helps for Superintendents

Breaking the Force of a Dredge Pump Discharge

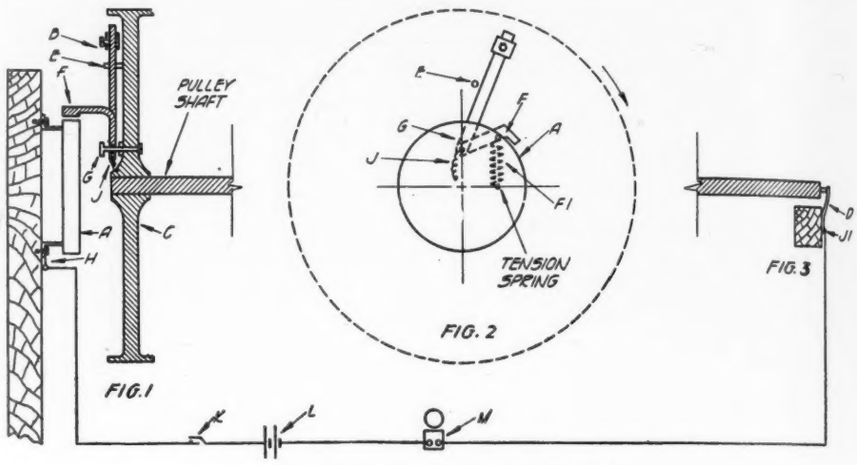
ONE of the small problems of dredging sand and gravel is to spread the discharge of the centrifugal pump in such a way that it will flow quietly to the gravity screens that are so much used where sand and gravel are pumped.

The picture shows a method used at the plant of the Louisiana Gravel and Sand Co. at Hattiesburg, Miss. The device consists of two old pump shells placed one above the other. The upper shell is closed above but opened below and the lower shell is open above and below. An old plate below the lower shell receives the impact of the gravel before it hits the "fanning table" below.

The pump discharge comes in through the upper of the two pipes shown. The lower pipe is merely to hold the lower shell in place. The force of the water is partly dissipated by the discharge whirling around in the upper shell. The discharge falls through and a cone of gravel which builds up in the lower shell forces it into the shell where whatever force it has left is dissipated so that it falls very quietly on the table and flows with a slow current across the table to the screen, spreading out as it does so to the width of the table.

Around every pumping plant that has been in operation for any considerable time there are discarded shells and pipe to make the arrangement shown so that the cost would be only that of the labor needed to install it.

This arrangement was devised by I. V. Austin, manager of the Louisiana Gravel and Sand Co., Hattiesburg, Miss.



Automatic signal warns of full crusher

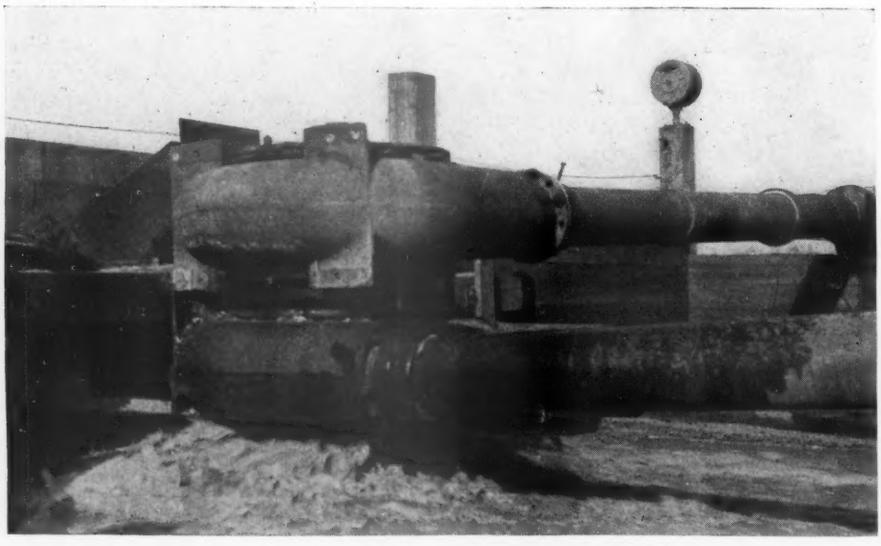
Automatic Signaling Device Prevents Damage to Crusher

MUCH trouble, delay and oftentimes damage to crushing machinery, are caused when material backs up into crushers because the conveyors carrying off the crushed material suddenly stop. Driving belts jumping off or pulling into the elevators may bring this condition about and to prevent this backing up an ingenious device has been worked out by T. D. Rivert of the Blue Ridge Slate Corp., Esmont, Va. This device which is illustrated above is attached to the elevators or conveyors carrying material away from the crushers.

Fig. 1 shows the counterweight B with contact arm F, the tension spring J and the counterweight arm G. The counterweight is adjustable by a set screw so as to hold it in any position (dependent on the speed of the wheel to which the arm is attached). The side view, Fig. 2, shows the direction of the wheel motion when the counterweight is applied as shown. The bond wire J is used to secure contact from G to the shaft or pulley. The tension wire F1 is attached to the lower spoke in the wheel so as to force the contact arm F into contact with the ring A, when the pulley is stopped at any point.

When the pulley C moves on a clockwise direction, the counterweight is forced counter clockwise by the pulley motion, thus breaking the contact between the point A (ring) and the arm F. When the pulley stops at any point, the spring F1 automatically forces F to A, closing the contact and causing the bell M to ring. The switch K is placed in the circuit to break contact in the line when the plant is not in operation. The stop pin E, which is placed behind the counterweight arm F, provides a stopping place for the counterweight arm when the wheel is in motion. Fig. 3 shows the brush D placed at the end of the shaft if convenient and attached to a wooden member. The wire is then passed from the battery L to the bell M on to the brush D and fastened at the point J1.

The entire system needs only a few feet of small wire and a "Hot Shot" battery of 6 volts. The signaling device is either a bell or red light so placed that the crusher operator can hear or see it and be thus able to cut off the crusher feed in case the alarm warns him that the conveying machinery has stopped. A small switch placed in the line enables the operator to cut off the signaling apparatus at times when the plant is not in operation.



Discarded shells and pipe go into the making of this device for breaking the force of a dredge pump discharge

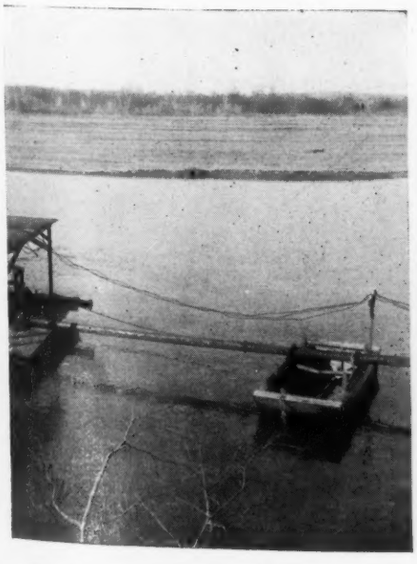
Old truck used to make good car puller

Car Puller Made from Truck

A CAR puller made from the transmission and drive of an old truck is shown in the accompanying photograph. The chassis of the truck was used as a mounting and other parts, including the chain drive, were utilized to give the proper reduction in speed. An electric motor was installed in the place of the gasoline engine that once drove the truck, but the transmission was retained to give the changes in speed necessary to start the cars easily.

A Deckless Pontoon

THE Arkansas River Sand Co. of Tulsa, Okla., operates pontoons which are not decked over but are open like a row boat. The manager of the company, W. E. Rogers, says that he prefers this to the ordinary decked pontoon for several reasons which seem sufficient.



Deckless pontoons carry dredge line

One is that the pontoon is lighter and rides a little higher. Another is that if a pontoon leaks it can be seen at once and repaired. A third is that it can be quickly bailed out if water either from a leak or from rains enters. As there is no danger of water condensing on the inside of the hull, the hull in his opinion lasts longer, and the inside of the hull can be kept in condition by painting. Finally, in a pinch, a pontoon may be used as a boat, and a spare pontoon makes an excellent "joe boat" when a length of pipe is to be added.

Whether these advantages overweigh the advantages of a decked pontoon or not are left to the judgment of the reader. The decked pontoon is stronger, will not collect rain water and gives a better chance to support the pipe. It is not so easily sunk and probably will last longer with ordinary care than the pontoon of the conventional type.

Proper Selection of Welding Rods

AMONG the several distinct factors which all work together for good welds is the selection and use of the correct welding rod.

Various kinds of steel rods have been developed for different duties. If a steel shaft, for instance, is to be welded, a good grade of nickel steel rod containing about 3.50% nickel should be used, because a much higher tensile strength is required for a shaft repair than can be obtained with a mild steel rod. Further, not only is the proper kind of welding rod an essential, but the chances for successful welding are greatly enhanced by the use of rods which are of definite standard analysis. The welder therefore should utilize the products put forth by reliable manufacturers and which are guaranteed by them to be uniform in composition.

By selecting the correct welding rod for each job, moreover, the operator can insure the maximum of strength, tightness and dependability possible in the metal given him to weld.—*Oxy-Acetylene Tips.*

Old Automobiles Used To Protect River Bank

ALONG the Arkansas river the sand producers have often to take precautions against the cutting away of the bank by the river. It has happened more than once that the river channel has changed so as to cut the ground away from a sand plant or else has cut the opposite bank so as to leave the plant high and dry, too far away from the channel to be of any use. Hence the sand producers watch the bank and try to protect it against the cutting that may come in a flood period.

Stone makes the best rip-rapping but it is too expensive. Brush is generally used where it can be had near the point that is to be protected. Some years ago a method of rip-rapping was patented which used steel frames joined together by chains. These were put in the river along the bank and the eddies set up caused the sand to settle around the frames until a solid bank was formed. This made the river do the work of rip-rapping.

A substitute for "rip-rap"

Understanding this the Smith Sand Co. of Tulsa, Okla., decided that old automobiles could be used as well as the steel frames. There were plenty of them in Tulsa, as in every city, and the people who had them were glad to find a place in which to dispose of them. The cost to the sand company was nothing as they did not have to pay even the expense of bringing them to the river bank. A considerable stretch of the bank has already been protected with old automobiles and a supply has been accumulated that will serve for future operations.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	Aug. 17	No par	44	46	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	Aug. 17	100	115	.....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	Aug. 16	No par	34½	34½	45c qu., 15c ext. July 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Aug. 17	100	99	101	
Atlas Portland Cement Co. (common)[2]	Aug. 17	No par	45	47	50c quar. June 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	Aug. 17	33⅓	43	46	2% quar. July 1
Beaver Portland Cement Co. (1st Mort. 7's)[2]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (common)[4]	Aug. 16	100	130	135	1½% quar. June 30
Bessemer Limestone and Cement Co. (preferred)[4]	Aug. 16	100	107	108	1¾% quar. June 30
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	Aug. 16	.....	111	125	8% annual
Boston Sand and Gravel Co. (common)[10]	Aug. 13	100	63	66	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	Aug. 17	.....	.....	85	1¾% quar. July 1
Boston Sand and Gravel Co. (1st preferred)[10]	Aug. 17	.....	.....	95	2% quar. July 1
Canada Cement Co., Ltd. (common)	Aug. 18	100	105	.....	1½% quar. July 16
Canada Cement Co., Ltd. (preferred)[21]	Aug. 13	100	113¾	.....	1¾% quar. Aug. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[21]	Aug. 13	.....	102	103	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Aug. 13	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Aug. 16	No par	22½	24½	50c quar. July 12
Charles Warner Co. (preferred)	Aug. 16	100	99¼	103	1¾% quar. July 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	Aug. 13	100	102½	104	
Cleveland Stone Co. (new stock)	Aug. 18	.....	68	70	$1.50 qu. Sept. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Aug. 14	100	104	.....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	Aug. 19	.....	95	98½	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Aug. 19	100	98	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	Aug. 13	100	99	101½	
Dexter Portland Cement Co. (6% serial bonds, 1935)[22]	Aug. 19	.....	99	.....	
Dolese and Shepard Co. (crushed stone)[7]	Aug. 18	50	91½	93½	$1.50 quar. July 1, $1 ex. July 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	Aug. 14	.....	95	100	1¾% quar. July 1
Egyptian Portland Cement Co. (common)[21]	June 21	.....	18	20	40c quar. July 1
Egyptian Portland Cement Co. (warrants)[21]	June 21	.....	10	15	
Giant Portland Cement Co. (common)[2]	Aug. 17	50	55	60	
Giant Portland Cement Co. (preferred)[25]	Aug. 17	50	54	60	3½% s.-a. June 15
Ideal Cement Co. (common)	Aug. 18	No par	70	72	$1 quar. July 1
Ideal Cement Co. (preferred)[6]	Aug. 15	100	107	110	1¾% quar. July 1
International Cement Corporation (common)	Aug. 18	No par	54¾	54¾	$1 quar. June 30
International Cement Corporation (preferred)[2]	Aug. 18	100	104⅞	104⅞	1¾% quar. June 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Kelley Island Lime and Transport Co.	Aug. 18	100	126	130	$2 quar. July 1
Lawrence Portland Cement Co.[3]	Aug. 17	100	100	110	2% quar.
Lehigh Portland Cement Co.[6]	Aug. 17	50	84	87	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	Aug. 14	100	99½	100½	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	Aug. 14	100	97	99	
Marblehead Lime Co. (1st Mort. 7's)[14]	Aug. 14	100	104	106	
Marblehead Lime Co. (5½% notes)[14]	Aug. 14	100	98	100	
Michigan Limestone and Chemical Co. (common)[6]	Aug. 17	.....	23	26	
Michigan Limestone and Chemical Co. (preferred)[6]	Aug. 17	.....	22	24	1¾% quar. July 15
Missouri Portland Cement Co.	Aug. 18	25	57½	58	50c quar. Aug. 1, 25c ex. Aug. 1
Monolith Portland Cement Co. (common)[9]	Aug. 12	.....	11	11½	
Monolith Portland Cement Co. (units)[9]	Aug. 12	.....	27	28	
Monolith Portland Cement Co. (preferred)[9]	Aug. 12	.....	8	8¼	
Nazareth Cement Co.[23]	Aug. 13	No par	39	41	75c quar. Apr. 1
Newaygo Portland Cement Co.[3]	Aug. 16	.....	115	130	
New England Lime Co. (Series A, preferred)[14]	Jan. 29	100	96½	99	
New England Lime Co. (Series B, preferred)[23]	Aug. 3	100	92	96	
New England Lime Co. (V.T.C.)[22]	Aug. 3	.....	35	38	
New England Lime Co. (6s, 1935)[14]	Aug. 14	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	Aug. 16	100	98½	98⅞	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Aug. 14	.....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Aug. 17	.....	20	22	
North American Cement Corp. (preferred)	Dec. 31	.....	.....	.....	1.75 quar. Aug. 1
Pacific Portland Cement Co., Consolidated[5]	Aug. 13	100	72	73	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Aug. 13	.....	99	100	3% semi-annual Oct. 15
Peerless Portland Cement Co.[3]	Aug. 16	10	7	7½	
Petoskey Portland Cement Co.[3]	Aug. 18	10	9¼	9½	1½% quar.
Pittsfield Lime and Stone Co. (2 sh. pfd. and 1 com.)[10]	Aug. 17	.....	.....	225	
Rockland and Rockport Lime Corp. (1st preferred)[10]	Aug. 17	100	105	106	3½% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (2nd preferred)[10]	Aug. 17	100	.....	.....	3% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (common)[10]	Aug. 17	No par	50	50	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Aug. 18	100	118	135	$2 quar. Apr. 1
Santa Cruz Portland Cement Co. (bonds)[5]	Aug. 13	.....	105	106	6% annual
Santa Cruz Portland Cement Co. (common)[5]	Aug. 13	50	81	.....	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (Class A)[20]	Aug. 12	.....	40	42	
Superior Portland Cement, Inc. (Class B)[20]	Aug. 12	.....	20½	21½	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	July 16	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	July 16	100	96	99	
United States Gypsum Co. (common)	Aug. 18	20	160¼	161	2% quar., $1 ex. Sept. 1
United States Gypsum Co. (preferred)	Aug. 18	100	120	.....	1¾% quar. Sept. 30
Universal Gypsum Co. (common)[3]	Aug. 18	No par	14¾	15½	
Universal Gypsum V.T.C.[3]	Aug. 19	No par	14½	15½	
Universal Gypsum Co. (preferred)[3]	Aug. 18	.....	71	73½	1¾% quar. Sept. 15
Universal Gypsum Co. (1st Mortgage 7% bonds)[3]	Aug. 19	.....	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds)[18]	Aug. 13	100	99	101	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	Aug. 19	100	98	100	
Wolverine Portland Cement Co.	Aug. 18	10	5½	5½	2% quar. Aug. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 72

Editorial Comment

Road Maintenance

The expense of maintaining gravel roads increases so rapidly that paved roads may come to be preferred as highways on which the density of traffic is relatively low. Minnesota reports an increase of 55% in the cost of maintaining gravel roads in 1925, based on costs in 1923. In dollars the figures are even more impressive than in percentage. In 1923 the cost was $725.76 per mile for a road carrying 1,000 vehicles per day and in 1925 it was $1,019.24. Iowa maintenance for the same years, on all graveled roads, rose from $441 to $519.

Higher speed for traffic, increase in the length of the tourist season, and a greater use of cars in winter are the causes for increased maintenance costs. For maintaining concrete highways in both states the average cost is in the neighborhood of $200 per mile, $50 for the maintenance of the slab and the remainder for shoulder grade and guard rail repairs and replacements. The figures are from the service bulletin of the Iowa Highway Commission.

It is evident that the difference between the highest maintenance cost quoted for gravel roads and the cost of maintaining a concrete slab would pay the interest on a considerable sum. At 5% this would be approximately $16,400. If one adds to this the cost of the gravel road, the cost of the extra gasoline and tires required by a lower class highway and the extra wear and tear on the vehicle it is probable that some form of paved highway (not necessarily concrete) would be considerably cheaper in the end, even for a road carrying no more than 1,000 vehicles per day.

The Sodium Sulphate Test

Probably no test applied to aggregate has caused more discussion than the "accelerated soundness test" employing sodium sulphate and supposed to represent the effect of freezing and thawing. The regular method of applying it is to soak the rocks or pebbles to be tested in a saturated solution of sodium sulphate for 20 hours and then to dry for four hours. Crystals of sodium sulphate will form in any crack in the specimen and tend to break it. If the sample survives five successive treatments it is judged to be sound.

Objectors are pointing out that the test will determine some rocks to be unsound which have stood a severe climate for many years. They further point out that it gives no quantitative results and that no ordinary laboratory sample can be fairly considered representative of a large tonnage in a test of this kind. The objections are sustained to the extent that certain specification making bodies do not consider the test as final. The American Concrete Institute specifications, for example, permit aggregate which has failed in the sodium sulphate test to be used provided it stands the freezing and thawing test.

The Illinois Highway Department has proposed a modification of the test using a single treatment with sodium sulphate followed by 5,000 revolutions in the Deval machine. Comparison with an untreated sample gives a measure of the effect of sodium sulphate. Other laboratories are working for some modification of or substitute for this test that will be accepted as fair.

The matter is of the greatest importance to the producers of aggregates, both crushed stone and gravel. Aggregate must be sound; altogether too many cases of concrete failure have been traced to unsound aggregates. On the other hand the soundness test must be a fair one and there is more than a suspicion that the sodium sulphate test is unfair. The problem is one to which engineering and testing associations should bring their best efforts for a solution.

Business Cycles

The Bureau of Economic Research has studied the periods of expansion and depression known as business cycles between 1796 and 1923 and finds they average one every four years. But the "average shark" cannot get much comfort out of the returns; for some cycles lasted a year and some ran as long as nine years. Apparently there is as yet no law by which one can predict when the end of a cycle is due.

The important thing about business cycles is that we are beginning to study them and to provide methods of minimizing their effect. Depressions in the United States, such as followed the very scanty cotton crop in Texas last year, have been somehow localized so that their effect was not felt generally. The policy of the government in deferring public buildings so long as private enterprises furnish an ample market for labor and materials is also having its effect.

Studying Road Bases

Looking over the records of the research work being carried on by state highway departments one notes that in many states the matter of sub-grades is being carefully studied. This is as important to cement and aggregate producers as it is to those who pay for and use the highways. Unquestionably concrete materials have more than once been blamed for cracked roads when the blame really lay with the bad condition of the grade on which the pavement was laid. The state departments are the proper ones to make such investigations, as each state has its own peculiar conditions of grade to meet.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	.....	70	.....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	.....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	.....	$12 for the lot	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	.....	$66 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼% semi-annua.
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅝	
Phosphate Mining Co. (1)	Nov. 25	.....	1@5	.....	
Pittsfield Lime and Stone Co. (preferred)	.....	100	.....	.....	2% quar. Apr. 1
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	.....	$200 for the lot		
Rock Plaster Corp. (390 sh. com., no par) (2)	Mar. 17	.....	$12 for the lot	.....	
Simbroco Stone Co. (pfd.)	Dec. 12	.....	.....	.....	$2 Jan. 1
Tidewater Portland Cement Co. (common) (3)	Nov. 25	.....	8½	.....	
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (4)	Dec. 30	.....	$1 for the lot	.....	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925.

U. S. Gypsum Earnings

NET earnings of the United States Gypsum Co. for the six months ended June 30 were slightly ahead of the same period last year, amounting to $4,130,829 or $7.54 a share on the 506,915 shares of common stock now outstanding after the deduction of preferred dividends. This compares with $4,091,268 or $7.46 a share on the common in the same period a year ago on the basis of the present capitalization. These figures are made public in the first semi-annual financial statement ever published by the company.

The directors have declared an extra dividend of $1 per share on the common stock, par $20, in addition to the regular quarterly dividends of 1¾% on the preferred stock and 40 cents per share on the common stock, all payable on Sept. 1. Like amounts were paid last quarter.

Sewell L. Avery, president of the company, makes no statement in regard to the policy of issuing the semi-annual report, but points out that the figures reflect conditions as favorable as in the same period of 1925. He says: "Building continues at a high rate and present indications point to a large business for the third quarter and justify hopes that it may continue throughout the year."

While surplus for the period is slightly lower than in the same period a year ago this is due to the increase in the amount of dividends paid on the common stock. Total operating earnings for the period were $5,189,532 as compared with $4,998,670 in the first half of 1925.

A comparison of the income account for the six months ended June 30 follows:

	1926	1925
*Net earnings	$5,189,532	$4,998,670
Depreciation and depletion reserve	433,085	341,066
Federal taxes	625,618	566,336
Net income	$4,130,829	$4,091,268
Dividends paid	1,201,359	1,083,309
Surplus	$2,929,470	$3,007,959

*After operating expense, repairs and maintenance.

Reports were current that the United States Gypsum Co. had effected a settlement of infringement litigation which it had entered against a number of plasterboard manufacturers, involving payment to the United States Gypsum Co. of a large amount of cash in royalties and damages. Although unconfirmed, it is understood that attempts are being made to reach an agreement on possible damages without further court proceedings. One rumor states that one basis for a settlement of the litigation is the payment by the alleged infringers of approximately $2,000,000 to the U. S. Gypsum Co.

Cleveland Stone Extras

THE stockholders of the Cleveland Stone Co. recently approved a plan to change the capital stock of the company from $100 par value shares to no par value shares and to distribute $100 per share in cash among stockholders. The concern has outstanding 40,000 shares of capital stock, par $100. A quarterly dividend of $1.50 per share, payable on Sept. 1, was also voted.

International Cement Semi-Annual Report

INTERNATIONAL CEMENT CORP. and subsidiaries for the quarter ended June 30 last reports a net income of $1,058,786 after charges, depreciation and federal taxes, equal after preferred dividends to $1.77 a share on 500,000 shares of no par common stock, against $746,171 net, or $1.15 a share earned in the last preceding quarter and $110,603 net, or $2.62 a share, on 400,000 shares outstanding in the second quarter of 1925. Net income for the first six months of 1926 was $1,804,957, equal to $2.92 a share on the common, against $1,824,541, or $4.26 a share, on the common in the first half of 1925.

The following table shows the comparative statements for first and second quarterly periods in 1925 and 1926:

INTERNATIONAL CEMENT CORP. SEMI-ANNUAL STATEMENT

	Period—3 Mos. End. June 30— 1926	1925	—6 Mos. End. June 30— 1926	1925
Gross sales	$6,856,967	$5,452,302	$11,705,169	$9,234,503
Less packages, discounts and allowances	1,265,479	990,663	2,123,826	1,641,239
Net sales	$5,591,488	$4,461,639	$9,581,343	$7,593,265
Manufacturing costs	2,757,880	2,126,799	4,716,297	3,636,152
Depreciation	465,286	270,406	717,701	441,761
Shipping, selling and administrative expenses	1,015,363	737,951	1,821,892	1,311,385
Net profit	$1,352,959	$1,326,482	$2,280,454	$2,203,966
Miscellaneous income	.....	5,150	.....	13,164
Total income	$1,352,959	$1,331,632	$2,280,454	$2,217,129
Interest charges and financial expenses	32,367	.....	33,585	.....
Reserve for Fed'l income taxes and contingencies	261,805	221,029	441,911	392,588
Net to surplus	$1,058,787	$1,110,603	$1,804,959	$1,824,542

Virginia Alberene Earnings

The following figures show the earnings of the Virginia Alberene Corp. (formerly the Alberene Stone Co.) for the first four months of 1926:

4 months ended April 30—	1926	1925
Manufacturing cost, etc.	500,586	473,477
Gross sales	$591,059	$519,271
Discounts, freights & allowances	19,706	21,578
Manufacturing profit	$ 70,767	$ 24,216
Other income	12,681	14,654
Gross income	$ 83,448	$ 38,871
Interest on first mortgage bonds	38,370	15,009
Other interest	6,238	4,106
Balance before depreciation, depletion, etc.	$ 38,839	$ 19,756

Smallwood Stone Bonds Offered

MAYNARD H. MURCH & CO., Cleveland, Ohio, are offering at prices to yield from 6% to 6½%, according to maturity, $500,000 1st (closed) mortgage 6½% serial gold bonds of the Smallwood Stone Co. of Ohio.

The following data are from a letter of W. M. Loy, president of the company:

Company.—Organized in Delaware, to take over the business of the Smallwood Stone Co., an Ohio corporation. The business was established in 1900. Company is engaged in the production of pulp stones used in the grinding of wood into paper pulp.

The quarries of the company are located, one at Empire, Ohio, on the Ohio River, adjacent to the Pennsylvania R. R., and another on the Monongahela River, adjacent to the Baltimore & Ohio R. R., near Fairmont, W. Va. These quarry properties contain over 100 acres, part of which, sufficient to indicate a reserve of suitable stone for over 30 years' supply, has been core drilled.

Sand-Lime Brick Production and Shipments in July

ACCORDING to statistics received from 14 sand-lime brick plants located in the United States and Canada, production of sand-lime brick for July was above that of the previous month. Shipments increased in proportion, the stocks on hand showed an increase and the total of unfilled orders, though still high, is about 5,000,000 less than the previous month. The plants reporting constitute about one-third of the number operating in the United States and Canada, but are the largest producers and their output is about one-half of the total production in the two countries. The following table gives comparative statistics for June and July:

Sand-Lime Brick Statistics for June and July, 1926

	June*	July
Production	17,940,000	20,819,000
Shipments (rail)	9,465,000	5,649,000
Shipments (truck)	8,302,000	10,996,000
Stocks	6,855,000	7,613,000
Unfilled orders	23,446,000	18,526,000

*Revised to include production of one plant not included in June report.

The following are average prices of sand-lime brick for July:

	Plant price.	Delivered
Hartford, Conn.	$16.00	$19.00
Milwaukee, Wis.	10.50	13.00
Minneapolis, Minn.	10.00	†12.75
Detroit, Mich.	13.60	16.30
Detroit, Mich.	14.40	17.50
Michigan City, Ind.	11.00	.....
Jackson, Mich.	12.25	.....
Toronto, Ont.	13.10	15.60
Woburn, Mass.	13.96	16.75
Dayton, Ohio	12.50	.....
Saginaw, Mich.	12.00	.....

†C.L., L.C.L., $16.50.

Production seems to have been set to keep pace with shipments and from the decline in the total of unfilled orders, it would appear that new orders obtained had fallen off a bit. However, the large excess of these unfilled orders over stocks on hand indicates that the industry is in sound condition. Minneapolis, Minn., territory reports that business has been rather quiet in that section. Conditions around Milwaukee are slightly better than last month, one plant reporting large shipments and about 75% of capacity production.

Several new buildings have been built with sand-lime brick in Connecticut and Michigan. The accompanying picture of the Second National Bank building at Saginaw is a fine example. The brick in this structure was furnished by the Saginaw Brick Co. of Saginaw.

There is a report circulating that one of the large importers of Belgian sand-lime brick at Brooklyn, N. Y., has been soliciting orders for German and Holland brick also. It is gratifying to note that the end of heavy importation of sand-lime brick is almost in sight. It was expected that importers would increase their shipments during the time that remains before the U. S. Treasury Department's new marking regulations goes into effect. But an examination of steamship manifests and charters indicate that they have not done so. From recent decisions by the Customs authorities with reference to the tariff act's marking regulation, there is good reason to believe that the importers will secure little, if any, modification of the brick-marking order. All of which is very helpful to the domestic producer who has had to compete with a foreign product made with cheap labor and usually entered at Eastern ports at a cost which was below production cost in this country.

Second National Bank Bldg., Saginaw, Mich.

Canadian Production Increases in 1925

Production of sand-lime brick in Canada in 1925 totalled 63,869,000, valued at $781,555, as compared with 55,873,000 worth $619,946 in 1924, according to a statement just issued by the Dominion Bureau of Statistics at Ottawa. Nine plants were in operation in 1925, of which seven were in Ontario and two in Manitoba; in 1924 there were 10 establishments in Ontario, one in Manitoba and one in Saskatchewan.

Capital employed in the sand-lime brick industry in 1925 amounted to $960,729 as against $1,346,239 in the previous years; employes number 205 as against 236 in 1924 and materials used in manufacture cost $130,155 in 1925 as compared with a corresponding figure of $181,260 in 1924.

The Leaside Brick and Sand Co. are soon to replace the plant at Leaside, Ont., which was recently destroyed by fire. The new plant, it is estimated, will cost about $70,000.

Fire Damages Hoosac Valley Lime Plant

THE four-kiln plant of the Hoosac Valley Lime Co. at Adams, Mass., was damaged to the extent of $15,000 recently when fire swept a portion of the structure, putting two kilns out of commission and destroying a runway over which limestone was hauled to the top of the kilns.

Temporary repairs were started at once and it is expected that operations at the plant will be delayed only slightly. A new steel structure will replace that destroyed by the fire. William Flaherty is president and general manager of the company.—*Boston (Mass.) Globe.*

Increased Sales of Barytes and Barium Products in 1925

STATISTICS compiled from reports made by domestic producers of barytes to the Bureau of Mines, Department of Commerce, show sales amounting to 228,063 short tons, valued at $1,703,097, in 1925—a gain of 16% in quantity and 10½% in value, as compared with 1924. While the total value of sales increased the average selling value, f.o.b. at mine, dropped from $7.85 to $7.47 a short ton.

Missouri was the largest producer, shipping 44% of the country's total output; Georgia ranked second, and Tennessee third.

Crude barytes sold by producers in the United States in 1924 and 1925:

	1924		1925	
State—	Short tons	Value	Short tons	Value
Georgia	71,776	$574,208	65,936	$475,618
Missouri	77,189	604,390	101,056	794,927
Tennessee	39,643	302,873	47,012	345,038
Oth'r St's[1]	7,724	59,273	14,059	87,514
	196,332	$1,540,744	228,063	$1,703,097

[1]1924: Alabama, Nevada, North Carolina, South Carolina, Virginia and Wisconsin; 1925: Arizona, Nevada, North Carolina, South Carolina, Virginia and Wisconsin.

Barium Products

Sales of barium products, reported by domestic producers in 1925, amounted to 213,347 short tons, valued at $17,434,378—an increase of 29% in quantity and 20% in value as compared with sales in 1924.

Nearly 90% of the ground barytes sold was manufactured in Missouri. Seven lithopone plants in the middle Atlantic states and four plants in Illinois were operated during the year. Figures on barium chemicals include only those made directly from barytes or from primary salts of barium produced in the same plant.

Barium Products Made in the United States from Domestic and Imported Crude Ores and Sold in 1924-25

	1924		1925	
	Short tons	Value	Short tons	Value
Ground barytes	38,296	$784,881	49,674	$1,040,461
Lithopone	109,469	12,531,397	145,019	15,186,147
Barium chemicals:				
Carbonate	6,058	411,332	4,962	279,346
Chloride	3,859	297,182		
Sulphate (blanc fixe)	7,796	464,152	13,692	928,424
Other[2]	441	41,234		

[2] 1924: Hydroxide and sulphide; 1925: Chloride, hydroxide, sulphate and sulphide.

Portland Cement Output in July

Record Production of 17,121,000 Barrels— Shipments and Stock Under Previous Month

JULY production of portland cement was the greatest for any single month, according to the Bureau of Mines, Department of Commerce. The figures show that 17,121,000 bbl. were made; this is almost 2% more than the preceding month and nearly 10% greater than July, 1925. Shipments declined over the last month but were still high and were 3% greater than the shipments in July, 1925. Stocks of finished cement decreased almost 10% as compared with June, but were more than 23% greater than on July 31, 1925. These statistics, prepared by the Division of Mineral Resources and Statistics of the Bureau of Mines, are compiled from reports for July, 1926, received direct from all manufacturing plants except three, for which estimates were necessary on account of lack of returns.

Clinker Stocks

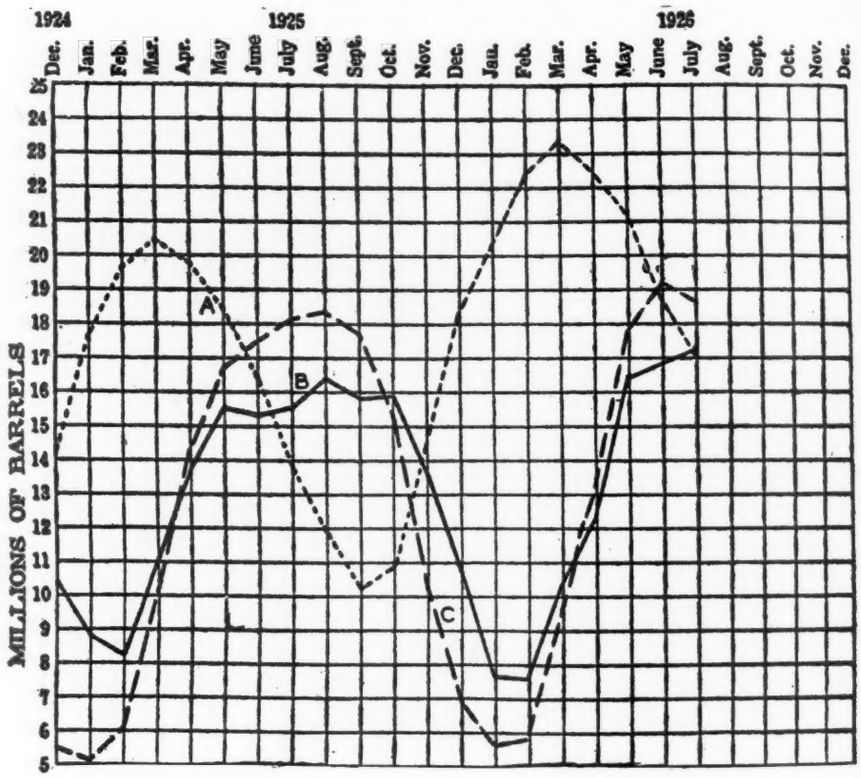
Stocks of clinker, or unground cement, at the mills at the end of July, 1926, amounted to about 8,490,000 bbl. compared with 10,086,000 bbl. (revised) at the beginning of the month.

An estimate of the unground clinker by months is given below:

ESTIMATED CLINKER (UNGROUND CEMENT) AT THE MILLS AT END OF EACH MONTH, 1925 AND 1926, IN BARRELS

Month	1925	1926*
January	7,017,000	9,074,000
February	8,497,000	10,931,000
March	9,962,000	12,284,000
April	9,731,000	12,934,000
May	9,053,000	11,649,000
June	7,937,000	*10,086,000
July	6,961,000	8,490,000
August	5,640,000	
September	4,561,000	
October	4,086,000	
November	5,013,000	
December	6,469,000	

MONTHLY FLUCTUATIONS IN PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT


1924
1925
1926
Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
MILLIONS OF BARRELS
25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5
A
B
C

(A) Stocks of finished portland cement at factories, (B) Production of finished portland cement, (C) Shipments of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during the months of May and June, 1925 and 1926:

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN MAY AND JUNE, 1925 AND 1926, IN BARRELS*

Shipped to—	1925—May	1926—May	1925—June	1926—June
Alabama	185,314	184,774	214,195	215,891
Alaska	0	2,296	1,284	1,130
Arizona	32,749	37,717	32,451	46,262
Arkansas	87,340	64,713	92,101	66,835
California	1,081,945	1,165,540	1,066,088	1,187,724
Colorado	125,744	119,761	120,818	124,451
Connecticut	177,292	209,515	172,564	206,301
Delaware	28,892	38,972	37,330	45,642
District of Columbia	103,996	85,961	81,334	86,218
Florida	313,846	386,712	348,330	297,204
Georgia	127,545	186,398	129,748	174,488
Hawaii	5,608	13,705	6,108	14,360
Idaho	28,613	58,044	28,122	54,424
Illinois	1,790,601	1,671,317	1,636,329	1,854,806
Indiana	569,436	548,639	617,360	635,118
Iowa	346,484	317,323	310,558	329,422
Kansas	242,880	259,208	233,522	247,335
Kentucky	195,351	185,751	231,491	176,187
Louisiana	99,402	96,519	100,016	106,338
Maine	38,435	51,441	43,541	66,264
Maryland	231,935	279,126	249,105	244,763
Massachusetts	374,243	362,878	350,620	338,079
Michigan	1,140,027	1,206,893	1,264,462	1,469,758
Minnesota	425,473	496,800	409,235	526,695
Mississippi	47,573	73,146	66,012	73,345
Missouri	652,330	696,773	583,561	631,184
Montana	28,170	23,832	28,904	23,114
Nebraska	198,333	190,275	181,516	187,780
Nevada	11,676	8,165	10,784	9,895
New Hampshire	36,814	46,559	40,837	48,285
New Jersey	721,605	770,730	737,572	773,450
New Mexico	17,141	12,004	18,406	16,222
New York	2,028,808	2,223,644	2,090,644	2,475,868
North Carolina	289,056	424,474	324,201	420,248
North Dakota	47,789	58,351	66,089	75,470
Ohio	1,054,230	1,186,056	1,099,767	1,310,691
Oklahoma	235,096	229,209	225,879	219,946
Oregon	129,048	127,318	134,038	150,962
Pennsylvania	1,482,560	1,613,851	1,869,299	1,697,387
Porto Rico	0	0	0	0
Rhode Island	72,914	96,407	89,213	80,912
South Carolina	74,198	58,544	85,087	47,279
South Dakota	66,445	61,899	59,120	53,091
Tennessee	163,812	201,130	185,536	206,917
Texas	373,605	431,778	411,795	447,231
Utah	41,447	31,753	37,733	66,883
Vermont	24,178	28,202	26,978	32,291
Virginia	154,167	196,368	172,760	211,665
Washington	265,735	212,259	328,589	260,756
West Virginia	140,992	217,387	161,484	208,308
Wisconsin	507,654	537,441	569,687	691,934
Wyoming	32,466	17,558	31,290	20,331
Unspecified	8,023	69,750	3,996	81,004
	16,659,016	17,874,866	17,417,489	19,038,145
Foreign countries	75,984	76,134	83,511	74,855
Total shipped from cement plants	16,735,000	17,951,000	17,501,000	†19,113,000

*Includes estimated distribution of shipments from three plants in May and June, 1926, and from four plants in May and June, 1925.
†Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1925 AND 1926, IN BARRELS

Month	Production 1925	Production 1926	Shipments 1925	Shipments 1926	Stocks at end of month 1925	Stocks at end of month 1926
January	8,856,000	7,887,000	5,162,000	5,672,000	17,656,000	20,582,000
February	8,255,000	7,731,000	6,015,000	5,820,000	19,689,000	22,384,000
March	11,034,000	10,355,000	10,279,000	9,539,000	20,469,000	23,200,000
First quarter	28,145,000	25,973,000	21,456,000	21,031,000	.....	.....
April	13,807,000	12,401,000	14,394,000	12,961,000	19,877,000	22,640,000
May	15,503,000	16,472,000	16,735,000	17,951,000	18,440,000	21,173,000
June	15,387,000	16,827,000	17,501,000	*19,113,000	16,409,000	*18,900,000
Second quarter	44,697,000	45,700,000	48,630,000	50,025,000	.....	.....
July	15,641,000	17,121,000	18,131,000	18,767,000	13,896,000	17,254,000
August	16,419,000	.....	18,383,000	.....	11,952,000	.....
September	15,939,000	.....	17,711,000	.....	10,247,000	.....
Third quarter	47,999,000	.....	54,225,000	.....	.....	.....
October	15,992,000	.....	15,309,000	.....	10,979,000	.....
November	13,656,000	.....	10,187,000	.....	14,534,000	.....
December	10,713,000	.....	6,917,000	.....	18,365,000	.....
Fourth quarter	40,361,000	.....	32,413,000	.....	.....	.....
	161,202,000	.....	156,724,000	.....	.....	.....

*Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS IN JULY, 1925 AND 1926, AND STOCKS IN JUNE, 1926, IN BARRELS

Commercial district	Production 1925—July	Production 1926—July	Shipments 1925—July	Shipments 1926—July	Stocks at end of 1925—July	Stocks at end of 1926—July	Stocks at end of June, 1926*
E'n Penn., N. J. & Md.	3,703,000	3,935,000	4,564,000	4,215,000	2,460,000	3,687,000	3,967,000
New York	838,000	911,000	1,045,000	1,146,000	757,000	992,000	1,227,000
Ohio, W'n Penn. & W. Va.	1,618,000	1,797,000	1,754,000	2,006,000	1,612,000	2,017,000	2,226,000
Michigan	1,223,000	1,506,000	1,322,000	1,681,000	967,000	1,588,000	1,734,000
Wis., Ill., Ind. & Ky.	2,249,000	2,453,000	2,743,000	3,018,000	2,611,000	2,400,000	2,964,000
Va., Tenn., Ala. & Ga.	1,230,000	1,445,000	1,375,000	1,420,000	264,000	1,150,000	1,125,000
E'n Mo., Ia., Minn. & S. Dak.	1,444,000	1,602,000	1,846,000	1,756,000	2,399,000	2,263,000	2,417,000
W'n Mo., Neb., Kans. & Okla.	1,110,000	1,067,000	1,187,000	1,160,000	1,529,000	1,361,000	1,454,000
Texas	454,000	459,000	463,000	464,000	232,000	472,000	478,000
California	1,122,000	1,302,000	1,139,000	1,276,000	435,000	528,000	502,000
Colo. & Utah	246,000	644,000	208,000	625,000	382,000	826,000	806,000
Ore., Wash. & Mont.	404,000		485,000		248,000		
	15,641,000	17,121,000	18,131,000	18,767,000	13,896,000	17,254,000	18,900,000

*Revised.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN JUNE, 1926

Imported from	District into which imported	Barrels	Value
Belgium	Florida	5,051	$ 10,255
	Los Angeles	4,629	6,354
	Maine & N. H.	6,308	12,990
	Massachusetts	84,203	132,874
	Mobile	10,974	16,734
	New Orleans	29,799	41,720
	New York	185	824
	Oregon	5,832	7,901
	Philadelphia	41,839	67,139
	Porto Rico	8,620	18,675
	San Francisco	7,602	9,694
	South Carolina	3,003	4,506
	Washington	27,167	44,451
	Total	235,212	$374.117
Canada	Florida	57,722	$ 54,285
	Maine & N. H.	71	273
	Total	57,793	$ 54,558
Denmark and Faroe Islands	Massachusetts	22,085	$ 30,979
Finland	Rochester	1,197	$ 2,309
France	Massachusetts	2,472	$ 2,525
	New Orleans	953	1,893
	New York	614	734
	San Francisco	596	1,680
	Total	4,635	$ 6,832
Germany	New Orleans	2,621	$ 2,467
	Hawaii	9,496	$ 18,512
United Kingdom	Massachusetts	1,281	$ 3,244
	New Orleans	208	472
	New York	1,042	2,254
	Total	2,531	$ 5,970
	Grand total	335,570	$495,744

EXPORTS AND IMPORTS*
EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES, IN JUNE, 1926

Exported to	Barrels	Value
Canada	2,666	$ 10,560
Central America	1,537	4,914
Cuba	9,976	23,868
Other West Indies	4,624	10,473
Mexico	16,600	52,678
South America	39,995	121,552
Other countries	5,286	24,769
	80,684	248,814

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO IN JUNE, 1926*

	Barrels	Value
Alaska	1,768	$ 5,753
Hawaii	11,823	28,398
Porto Rico	2,955	9,048
	16,546	$43,199

*Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1925 AND 1926

Month	Exports 1925 Barrels	Exports 1925 Value	Exports 1926 Barrels	Exports 1926 Value	Imports 1925 Barrels	Imports 1925 Value	Imports 1926 Barrels	Imports 1926 Value
January	71,596	$207,547	72,939	$216,431	231,258	$ 364,196	360,580	$576,717
February	56,249	181,356	73,975	220,706	119,077	206,308	314,118	527,948
March	65,248	200,410	69,080	205,647	218,048	337,039	493,241	812,968
April	89,508	263,831	96,296	284,772	197,686	280,826	257,302	398,114
May	85,385	250,845	78,601	224,365	186,897	286,959	223,130	337,031
June	71,343	217,889	80,684	248,814	254,937	409,539	335,570	495,744
July	98,141	286,543	.....	.....	335,118	499,602	.....	.....
August	103,961	289,904	.....	.....	379,847	611,551	.....	.....
September	102,649	285,225	.....	.....	513,252	789,121	.....	.....
October	73,369	228,467	.....	.....	535,050	824,268	.....	.....
November	101,825	294,201	.....	.....	388,604	678,518	.....	.....
December	100,323	296,900	.....	.....	295,543	526,001	.....	.....
	1,019,597	$3,003,128	.....	.....	3,655,317	$5,813,928	.....	.....

A Menace to the Portland Cement Industry

An Editorial in "Roads and Streets"

IF protection of home industries is to remain a national policy, the time has arrived to increase the tariff on portland cement, for during the first quarter of this year nearly $2,000,000 of cement was imported. This is about double the importation during the first quarter of 1925. The rapid increase clearly indicates the seriousness of the situation.

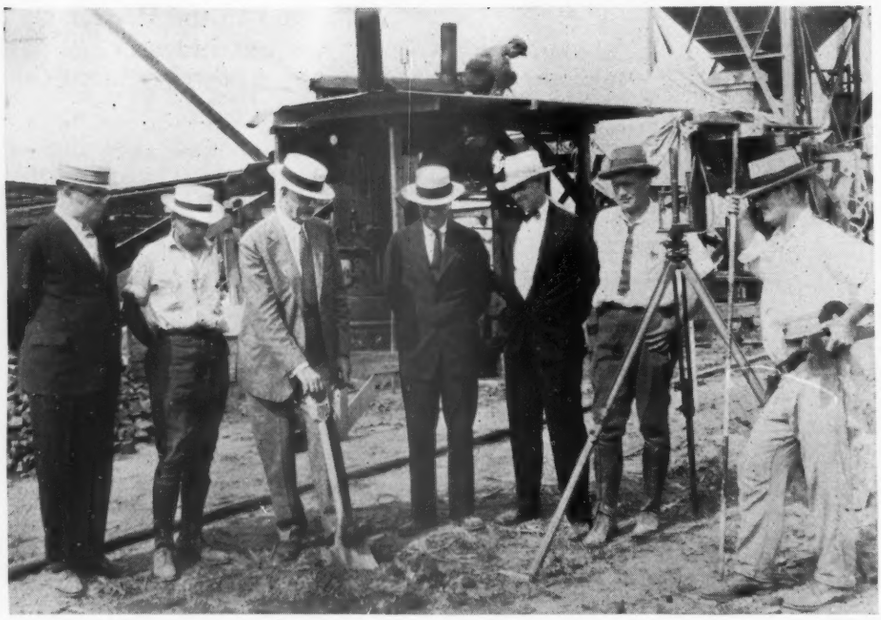
Foreign cement sells at Atlantic coast points at 40 to 60 cents a barrel below the price of domestic cement. About 75% of the cement comes from Belgium and 20% from Denmark and Faroe Islands. Curiously enough, much of it is brought in U. S. Shipping Board vessels. Thus a "merchant marine," built to extend American commerce abroad, is being used, in this instance, to cripple American industries at home.

The present producing capacity of American cement mills is about 200,000,000 bbl. annually, and it will be only a few months before this is increased to about 210,000,000 bbl. Last year (1925) was the greatest year for cement consumption. About 158,000,000 bbl. were marketed, or less than 80% of the then capacity of the mills.

The investment in the American cement industry is conservatively estimated at half a billion dollars. This vast industry has been built up largely as a result of the educational work carried on for many years by the cement manufacturers who are associated in an educational research enterprise known as the Portland Cement Association. If foreign producers are allowed the benefit from this educational work, it will be at the expense of American cement manufacturers and their employes.

Although a score of cement mills are operating within a few miles of Philadelphia, in the celebrated Lehigh district, we understand that not a single barrel of domestic cement is being used on the several million dollars' worth of street work now in progress in Philadelphia. Such instances make it clear that the importation of cement has already reached serious proportions.

We need not dwell on the irresponsibility of foreign cement manufacturers as to their product. Nor on the risks that exist in cement structures, where the cement lacks the proper strength. These are minor details compared with the very grave matter of injury to a great American industry.



Breaking ground for new Dewey Portland plant at Davenport, Iowa. In picture, left to right, are R. J. Eustace, industrial commissioner; William Norton, resident engineer of the J. C. Buckbee Co. of Chicago; George T. Baker; Don T. Tyler; William Saylor, and J. Rueffer, assistant engineers

Break Ground for New Plant

WITH the turning of the first shovel of earth by G. T. Baker, president of the Davenport Industrial Commission, the work on the new portland cement plant being built at Davenport, Iowa, by the Dewey Portland Cement Co., Kansas City, Mo., was formally begun. The first structure to be erected will be the office and restaurant building and this and others will be of cement products.

Railroad tracks from the Rock Island railroad are already in place and on sidings there are many carloads of such materials that are necessary. A steam shovel is at work excavating for the intake from the river. The Priester Construction Co., Davenport, Iowa, have the contract for the construction and the plant and all engineering work will be carried on by the J. C. Buckbee Co., Chicago, Ill.

The Dewey Portland Cement Co. owns and operates a large plant at Dewey, Okla. F. E. Tyler is president of the company; H. F. Tyler is vice-president; A. L. Frank, vice-president and sales manager; W. E. Tyler, treasurer, and R. W. Moore, secretary. Offices are at Kansas City, Mo.

Superior Cuts Production

ACCORDING to a report in the Seattle (Wash.) *Times*, the Superior Portland Cement Co., Inc., has curtailed production of cement at their Concrete, Wash., plant. An announcement made by the company is given several causes, chiefly competition with foreign cement, for diminishing production at a time when it is usually at its highest.

Although the Superior company's plant has never operated continuously throughout any full year, it has not before the present time reduced operations during July and August, John C. Eden, president of the company, said. The chief causes entering into the present situation, Mr. Eden said, are a greater cement plant capacity in the state of Washington than present requirements warrant, the importation of cheap foreign-made cement from Belgium and other countries, brought in virtually as ballast, and the completion of large works which a year ago required immense quantities of cement. Continuing, Mr. Eden said:

"Our stock of cement on hand at this time is the largest that we have ever had, and we feel that we can adequately serve our customers by running at only part capacity.

"During 1925 and 1926 the Superior company increased the capacity of its plant to such degree that it alone could supply all the cement requirements of western Washington if it should receive all the business offered. Such a condition is impossible, for there is another local cement plant with nearly as large a capacity as our own, and California and Oregon cement manufacturers ship into this state extensively.

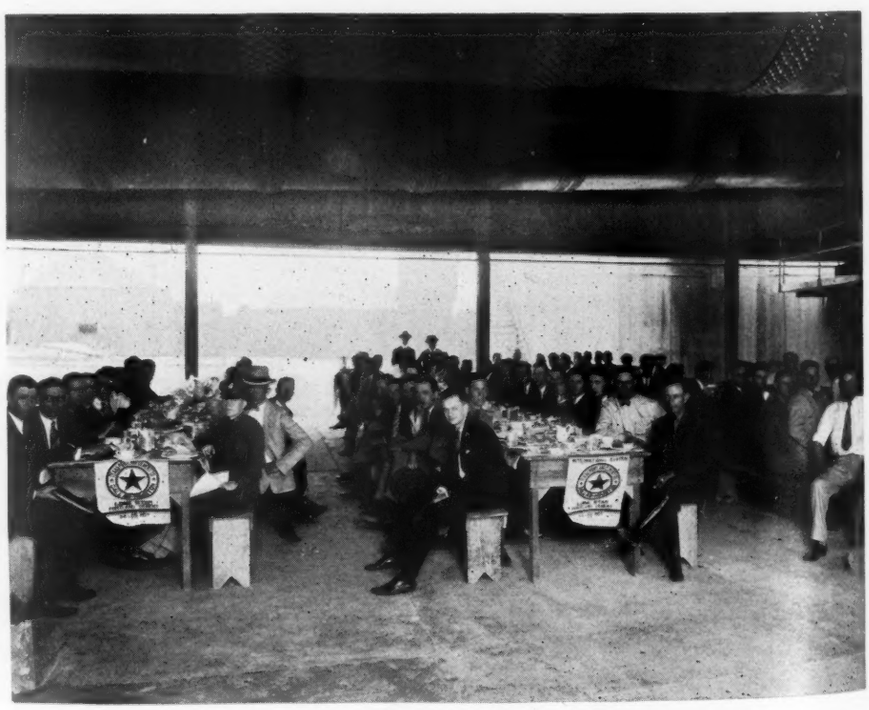
"We also lose a large part of possible cement business through transportation of the foreign product. Much of this latter comes here as ballast, and its price is low also because of low wages in Europe and differential in exchange. This means it can be sold for less than our local product, for we pay the American scale of wages and must meet rail freight rates that represent as much money for a single hundred miles as the cost of bringing cement all the way from Europe by water.

"The cement consumption in this state for the year 1926 will be approximately the same as the average for the past five years, approximating 2,000,000 bbl. The four cement plants now operating in this state have an annual capacity of more than 3,500,000 bbl."

Luncheon Right Under Kilns

IN the issue of ROCK PRODUCTS for July 10, editorial commendation was given to the "open door" policy of the International Cement Corporation, leading the management to welcome visitors at any of the plants.

On occasions when groups of visitors are entertained, and their coming is known in advance, a buffet luncheon is served right in the mill, emphasizing the cleanliness and freedom from dust.



Entertaining visitors at luncheon under kilns

Transfer of Dixie Stock Completes Cement Merger

ACCORDING to announcements in various newspapers, Richard Hardy, president of the Dixie Portland Cement Co., has turned over 75% of that company's stock to the committee in charge of the merger of the Dixie company with a number of other portland cement companies of the East. The purchase of the Dixie company's plant would be effective as of October, 1926, it is stated. The price is given at $8,000,000 and holders of the company's common stock, it is said, would get $280 a share for their holdings, or, if they desire, part cash and the remainder in stock of the new corporation.

The names of these companies have been withheld but it is currently reported that they are the Dexter Portland Cement Co., Pennsylvania Portland Cement Co. and the Clinchfield Portland Cement Co. The stock transfer, it is said, completes the merger of these four companies which produce about 10,000,000 bbl. per year and involve a capital of about $40,000,000.

A newspaper report containing confirmation of the merger by John A. Miller, president of the Dexter company, was published in ROCK PRODUCTS' July 24 issue. At that time it was said that Mr. Miller would head the new company, which was to be called the Pennsylvania Cement Co. The report contains details of the proposed bond issue and other matters concerning the finances of the new corporation. According to later reports, Richard Hardy is to take charge of the combined companies.

Decade of Cement Research at Lewis Institute

LEADERS in the cement industry and research scientists who have contributed largely to the improvements of portland cement and concrete were present at a recent luncheon at the Mid-day Club, Chicago, Ill. The meeting marked the tenth anniversary of the establishment of the Portland Cement Association's research laboratory at Lewis Institute, Chicago.

Prof. Duff A. Abrams, director of the laboratory, speaking at the luncheon, said: "The manufacturer cannot go to others for knowledge of his business. His practices must be based upon scientific knowledge. Although cement and concrete are older than the Christian era, more fundamental knowledge concerning the use of concrete has been gained in the last 10 years through research in this and other laboratories than during all the previous centuries."

Professor Abrams enumerated among the accomplishments of the laboratory the establishment of the correct ratio of water and cement for the manufacture of concrete, the institution of the colorimetric test for impurities in sands and the discovery of proper concrete curing methods, and studies in the time required for mixing and the effects of various admixtures on concrete. He said that the Chicago laboratory had become world-famous for its work and that it was visited by scientists from every country in the civilized world.

Another Georgia Cement Mill?

GREAT interest is being manifested in Washington county, Georgia, over the survey of certain lands near Sandersville by one of the largest cement companies in the country. Samples of rock recently shipped to chemists show this rock contains a very high grade of cement and it is said the supply is almost inexhaustible. While no definite information has been given out by engineers in charge of the survey, it is understood that the company plans to establish a plant two miles from this city for the manufacture of cement on a large scale. The plant will be located about one-half mile from the main line of the Georgia and Florida railroad.—*Augusta (Ga.) Chronicle.*

Increased Production of Mica in 1925

THE total quantity of uncut mica sold by producers in the United States in 1925, as reported by the Bureau of Mines, Department of Commerce, was 10,592 short tons, valued at $495,499. Of this quantity 897 tons (1,793,865 pounds), valued at $321,962, was sheet mica; the rest was scrap mica.

The production was made by 12 states, North Carolina, New Hampshire, South Dakota, New Mexico, Virginia, South Carolina, Georgia, Connecticut, Colorado, Alabama, Maine and Nevada, named in order of total quantity from greatest to least.

Domestic Uncut Mica Sold by Producers in the United States in 1924 and 1925

	Sheet mica		Scrap mica	
	Pounds	Value	Short tons	Value
North Carolina:				
1924	597,385	$108,656	3,212	$59,620
1925	592,478	105,376	5,095	74,818
New Hampshire:				
1924	744,133	88,737	492	9,498
1925	1,120,857	198,858	1,953	47,525
Other States*				
1924	119,379	14,642	1,005	18,124
1925	80,530	17,728	2,647	51,194
Total, 1924	1,460,897	212,035	4,709	87,242
1925	1,793,865	321,962	9,695	173,537

*1924: Alabama, Colorado, Connecticut, Georgia, New Mexico, South Carolina, South Dakota and Virginia; 1925: Alabama, Colorado, Connecticut, Georgia, Maine, Nevada, New Mexico, South Carolina, South Dakota and Virginia.

The total sales of uncut sheet mica in 1925 showed an increase of 23% in quantity and 52% in value, as compared with 1924. The total quantity of scrap mica sold was more than twice that of 1924, and the value was nearly twice as much.

The average value per pound of sheet mica sold in the United States in 1925 was about 18 c. and the average value of scrap mica a short ton was about $18.

The imports of mica for consumption were 4,901,308 pounds, valued at $1,798,827. Corresponding figures for 1924 were 5,801,151 pounds, valued at $2,326,906.

Newaygo Portland Offers to Buy Michigan State Cement Plant

AN offer to purchase the state cement plant at Chelsea, Mich., for $700,000 for the land, buildings and equipment and the inventory price for material and cement was submitted to the state administrative board recently by J. B. John, president of the Newaygo, Portland Cement Co., Newaygo, Mich. The proposal was referred to the state prison commission for a recommendation. The plant was purchased by the state, minus improvements and supplies, for $500,000. (See ROCK PRODUCTS, August 22, 1925, and January 23, 1926, for details in connection with the purchase.)

According to an inventory submitted to the board by Henry Croll, Jr., state budget director, the materials and so forth inventory at $388,747. If the offer is accepted the Newaygo company would, on this basis, pay approximately $1,000,000 for the plant. The state figures the plant and the buildings are worth $747,000. On the other hand a profit of $368,000 is claimed in the two and one-half years in which the plant has been operated by the state. Thus if a $47,000 loss is taken on the estimated worth of the plant, buildings and equipment, the state still would have a net profit of $316,000 on the deal, Croll claimed.

Quick assets, such as cash on hand and receivables, which would not be transferred to the Newaygo company on the event of the deal goes through, make up the $316,000 Croll estimates the state would profit.

Indications were the prison commission will recommend the plant be retained by the state.—*Grand Rapids (Mich.) Press.*

American Lime and Stone Company's Warehouse Burns

THE main warehouse of the American Lime and Stone Co., Bellefonte, Penn., was burned to the ground during a recent fire. The loss is set at between $15,000 and $18,000.

The fire, which was of unknown origin, started in the northwest corner of the large frame structure, and rapidly spread through the building. Both of the city fire companies were on hand promptly, but were greatly handicapped by the fact that contents of the warehouse were extremely dangerous to get close to. A large number of dynamite caps were stored in the building and exploded, and shortly after the arrival of the fire companies there was a great explosion in the interior of the flaming building. After the water was turned on the blaze it struck a quantity of carbide stored on the second floor and generated gas which added fuel to the flames. Several feet under the ground below the building was a large gasoline storage tank, upon which the firemen concentrated their efforts, and due to their work this escaped destruction, and probably saved much adjoining property—*Lock Haven (Penn.) Express.*

Crushed Stone Association Selects Detroit for Convention

FOLLOWING the precedent established in 1925, the semi-annual meeting of the board of directors of the National Crushed Stone Association was held at the Ambassador Hotel, Atlantic City, on Friday, July 30.

The meeting was exceedingly well attended, 25 being present from Canada, Texas and California, as well as from Wisconsin, Tennessee and states east of the Mississippi River.

The meeting was officially called to order at 10:15 a.m. with Chairman Graves presiding.

The first matter of importance to come before the meeting was whether or not the association should establish a research associate at the U. S. Bureau of Standards, such associate to engage in research investigation jointly outlined by the Bureau of Standards and the Bureau of Engineering of the National Crushed Stone Association. The results would be written up in the form of a report by the research associate. This report would then be reviewed by the editorial committee of the Bureau of Standards and if agreeable to them would finally be published as an official bulletin of the Bureau of Standards. The board enthusiastically approved this proposition and referred it to the executive committee with power to act when they felt it financially feasible to do so.

The question of establishing a testing laboratory in conjunction with the bureau of engineering of the association was then placed before the meeting. This was thoroughly discussed and it was finally decided "that it is the sense of this meeting that we should bear in mind the ultimate establishment of a testing laboratory when the finances of the association are such as to warrant this action."

The matter of placing the finances of the association on a firmer foundation was discussed and finally referred to the executive committee for a more detailed study, the results of which are to be reported back to the board at its next regular meeting.

Ways and means for increasing membership in the association were considered, final action being left to the discretion of the president.

It was proposed that the president, director of the bureau of engineering, secretary and such members of the board as could spare the time make a trip through the west for the purpose of meeting with and organizing crushed stone producers in the states west of the Mississippi river and to visit the capitals of these states for the purpose of effecting a more sympathetic understanding of the problems of mutual interest to the crushed stone producers and state highway departments.

It was felt by those present that a trip of this nature would be very desirable and do much to stimulate interest and gain new members throughout the western territory. The matter was referred to the executive committee with power to act.

The selection of the 1927 convention city

Otho M. Graves, President N. C. S. A.

next occupied the attention of the meeting and after carefully considering the advantages and disadvantages of the numerous suggested cities, it was decided to hold the 1927 convention at Detroit, Michigan, on January 17, 18, 19 and 20.

The Era of Competitive Materials

FROM now on a new kind of competition is going to manifest itself more and more. The building material manufacturing interests of the United States are not laying out $30,000,000 for promotional and educational development of their particular industries without providing for carrying the fight right to the site of the customer's building operation. A partial list of appropriations is going to be:

American Face Brick Association	$ 200,000
Associated Tile Manufacturers	75,000
Common Brick Manufacturers' Association	50,000
Portland Cement Association	400,000
Hollow Building Tile Association	50,000
Indiana Limestone Quarrymens' Association	75,000
National Lumber Association (5-year campaign)	5,000,000

Merle Thorpe, editor of one of the leading magazines in the lumber industry, says that if the individual firms in the basic building material industry making large appropriations for the new competition, were to be included in the list, it would total $30,000,000.

The great significance in the foregoing abbreviated list of industries planning to meet the eventualities of the years overlapping the forthcoming presidential campaign months, as seen by the foresighted business men of New York and vicinity, is that it marks the beginning of the long-expected readjustment period.

In other words, orders in the building business from now on will be sought for and fought for. The buyer is going to have his market back and he has got to be sold.

The appropriation of large sums of industrial funds for the express purpose of reaching out for that business that heretofore has been handed to preferred sellers in consideration of getting service or even ordinary facilities, means simply that the building material manufacturers have decided that the best way to keep their plants as busy as they have been since the war is to complete the sales cycle.—*Allen E. Beals in Dow Daily Building Reports.*

Making Lump Rock in a Limestone Mine

UNDERGROUND mining of limestone is becoming more common daily and it would be more used perhaps if it were not that it makes more fines than open quarrying. Ralph W. Smith, superintendent of the Peerless White Lime Co., St. Genevieve, Mo., has made a study of limestone mining to find the method which produces the least fines, and gives the result of his study in the May 29 issue of *Engineering and Mining Journal-Press.*

Mr. Smith finds the kind of explosive used to be the most important factor and says that slow ammonia dynamite is the best explosive. Black powder does not break out the holes well enough while 25% gelatine breaks the stone too small. Ammonia dynamite appears to be just right in speed and strength. Thirty-five per cent gelatine was altogether too fast.

Where a little more strength than could be given with ammonia dynamite was needed one or two sticks of gelatine were tamped down. Light holes are left with air spacing to prevent throwing of the rock.

Plenty of moist stemming is used in the holes and it is made of two-thirds damp red clay and one-third pulverized limestone. The drying out of the clay was found to increase the amount of fines. The stemming mixture is kept moist enough to form a ball when squeezed in the hand.

Blasts are fired while the men are in the mine and a red flare is used as a safety signal.

Rotan mill of the Universal Gypsum Co.

Universal Gypsum Combines With Palmer Lime

THE Universal Gypsum Co. of Chicago announces that it has completed its merger with the Palmer Lime and Cement Co. of New York, the new concern to be known as the Universal Gypsum and Lime Co.

The addition to the present board of directors of the Universal Gypsum Co. will be: J. N. Babcock, vice-president, Equitable Trust Bank of New York; Carleton Palmer, president, the Squibbs Chemical Co., New York; Lowell M. Palmer, Jr., president, Palmer Lime and Cement Co., New York; C. G. King, general manager, Palmer Lime and Cement Co., York, Penn.

The company's offices are located at Chicago Ill., New York, N. Y., Fort Dodge, Iowa, Atlanta, Ga., and Kansas City, Mo.

Gypsum mills are located at Akron and Batavia, N. Y., Fort Dodge, Iowa, and Rotan, Texas. Lime plants are at York, Penn., and Oranda, Va.

The merger puts the new corporation in possession of one of the most active and progressive lime plants in the United States, that of the Palmer Lime and Cement Co. at York, Penn. It was fully described in the December 9, 1923, issue of Rock Products. It consists of several distinct units: A drying, crushing and pulverizing plant for making ground limestone, a battery of 10 special Keystone kilns, a rotary kiln, two of the largest shaft kilns ever constructed, a lime hydrating plant which is one of the largest in the country, a lime storage plant and a plant for making chemically pure precipitated calcium carbonate. The Oranda, Va., lime plant was described briefly in the April 5, 1924, issue of Rock Products.

The Universal Gypsum Co. is a very large producer of gypsum and gypsum products. One of the newest plants of this company is situated at Rotan, Texas, where gypsite is used as a raw material. Four 12-ft. kettles calcine this, producing about 1200 tons per month of finished plaster. The new product "Insulex" is made at this plant. It was described in the March 6, 1926, issue of Rock Products.

The Akron, N. Y., plant of this company manufactures "Gypsolite" wall board from gypsum rock. This was one of the notable plants of 1925 and was described briefly in a review of the gypsum industry in the Annual Review number of that year. The same brand of wall board is also made at the Rotan plant.

It is announced by the company that a new plant, one of the largest and most modern gypsum operations in the United States, will be erected in the heart of Greater New York on the water front. This plant will cover an area of approximately eight acres, and will be accessible to the New York market through Newtown creek, a tributary to the East river, through the Long Island railroad and all trunk lines in New York City proper, including the New Haven railroad over Hell Gate bridge. As soon as completed this plant will turn out all the products manufactured at a first-class gypsum operation, including Insulex, wallboard, sheathing, neat plaster, sanded plaster, gypsum blocks, etc. It will therefore be possible to ship all gypsum and lime products from this plant in straight or mixed carloads.

The financial details of the merger, according to the Chicago *Journal of Commerce*, have not yet been quite completed.

Purchase of the Palmer company involved an exchange of stock and after the proposed financing the Universal Gypsum and Lime Co. will have a capitalization of $2,000,000 first mortgage 6% bonds, $4,000,000 of 7% preferred stock and 222,500 shares of no par value common stock.

The combined companies last year did a gross business of $4,687,951. The Palmer company has $3,500,000 assets and the new company, it is said, will have $10,000,000.

W. E. Shearer, president, Universal Gypsum Co.

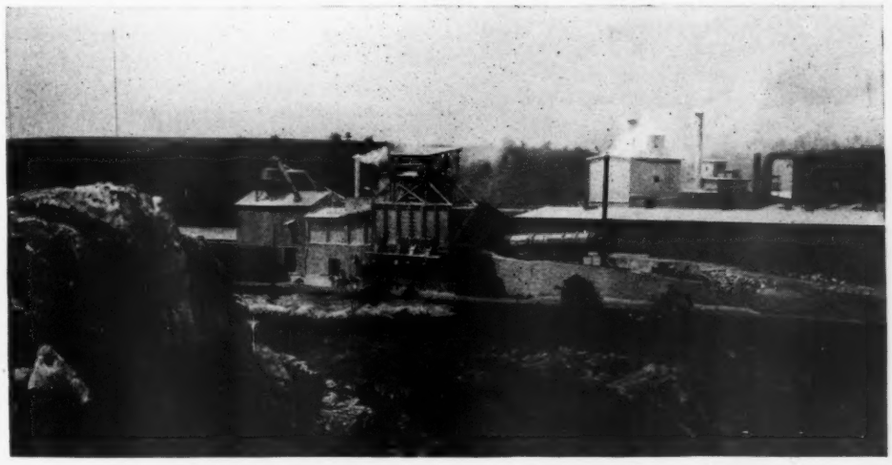
Canadian Phosphate in 1925

THE production of rock phosphate in Canada during 1925 amounted to 41 short tons, valued at $689, according to a report issued by the Dominion Bureau of Statistics.

Canadian importations, consisting almost entirely of Florida phosphate, totaled 14,002 short tons, valued at $62,107, in 1925, and 11,668 tons, valued at $56,965, in 1924.

Correction

IT was stated in the August 7 issue that Fred E. Hall of the T. J. Hall Co. of Cincinnati, Ohio, was to be chairman of the 1927 convention of the National Sand and Gravel Association. This should have read, "chairman of the convention committee."



York, Penn., lime plant of the Palmer Lime and Cement Co.

Mantua Company Launches New Dredge

A NEW dredge, the "City of Mantua," was launched recently by the Mantua Sand and Gravel Co., Mantua, Ohio. The boat will be used for dredging sand from the bottom of a pond located west of Mantua.

The boat is 20x40 ft., constructed of heavy timber, and when fully equipped will weigh about 40 tons. It will carry a 25-hp. electric motor and 12-in. suction pump, capable of loading 30 or 40 carloads a day, and will be operated by about five men. Pontoons will be constructed to carry the 12-in. pipeline which will have rubber joints so that it may be moved to any position on the pond. It will carry a stream of 15% sand and 85% water to the wash house, about a quarter of a mile away, near the railroad.

Ohio Company Purchases Gravel Reserves

THE Ohio River Gravel Co., Parkersburg, W. Va., has purchased Wheeling's Coney Island, situated in the Ohio river north of Martins Ferry, W. Va. Dredges have been put to work reclaiming sand and gravel from the southern point of the island.

The company has purchased several other small islands in anticipation of a possible federal tax on materials obtained from the river bed. By these purchases the company is assured of a source of supply for a number of years without the payment of any dredging taxes.—*East Liverpool (Ohio) Review.*

World's Largest Mixed Concrete Plant at Pittsburgh

WHAT is said to be the largest ready-mix concrete plant in the world was recently put into operation at Pittsburgh, Penn. The new plant, the property of the Ready Mixed Concrete Co., was erected at a cost of over $100,000 and has a maximum output of 100 cu. yd. of concrete per hour.

The main unit is built of reinforced concrete and contains a mixer with a capacity of 3 yd. every two minutes. Above the mixer is the operating room containing the measuring devices in which the sand, gravel, cement and water are proportioned either by weight or volume before passing into the mixer. Over the operating platform are the storage bins holding 200 tons of gravel, 100 tons of sand and two carloads of bulk cement.

In addition to this plant there is an emergency unit of 1 cu. yd. capacity, the combined plants giving a maximum output of 1000 cu. yd. of ready mixed concrete every 10 hours.

The Ready Mixed Concrete Co. also mixes ready mixed lime mortar. To transport the mixed concrete the company has just placed in operation a fleet of 10 especially designed trucks.

The Ready Mixed Concrete Co. was organized about a year ago by Edward N. Jones, former superintendent of police of Pittsburgh. The officers of the company, in addition to Mr. Jones, president and general manager, are Herbert Sander, treasurer; Maurice Vilsack, secretary. The directors are the above and Charles A. Finley, John Swan, Miles Bryan and Harry Kleinhans.—*Pittsburgh (Penn.) Post.*

Ask Receiver for Lime Company

BUSINESS men of Corydon, Ind., who financed the Railroaders' Lime Co. when it started operation at the old McGrain quarry near Corydon, have decided to ask the court for the appointment of a receiver for the company.

This company is a subsidiary of the Railroaders' Gas Co., which was recently placed in the hands of receivers since which time operations have been suspended at the quarry.

By having a receiver appointed and by securing the services of a competent superintendent it is thought that the quarry may be operated profitably to furnish stone for projected road improvements in the locality. The lime business has not been developed, the company having confined its operations principally to producing crushed stone for highway work.

C. N. Conner Appointed by Highway Research Board

ANNOUNCEMENT is made by Charles M. Upham, director, Highway Research Board of the National Research Council, that C. N. Conner, formerly state construction engineer, North Carolina Highway Commission, and more recently chief engineer, Mexican National Highway Commission, has been designated chairman of the earth roads investigation being conducted under the auspices of the Highway Research Board. Mr. Conner will give full time to this work, continuing the investigation of intermediate type road treatments and experiments from the preliminary stages through which it has thus far been conducted.

Mr. Conner was graduated from Tufts College, Massachusetts, in 1908 and has had a wide experience in engineering work with various state highway boards and with the U. S. Navy and War departments.

C. N. Reitz New General Manager of Superior Portland

CHARLES N. REITZ has been recently made vice president and general manager of the Superior Portland Cement, Inc., of Seattle, Wash. Mr. Reitz, previous to taking up his new duties, was district manager of the Pacific coast division of the Portland Cement Association. Following Mr. Reitz's resignation as district manager, J. E. Jellick, district engineer, has been announced to succeed him and A. H. Potts appointed to the district engineer's office vacated by Mr. Jellick.

Gypsum Mined and Sold by Producers in 1925

THE gypsum industry was highly productive in 1925, according to a statement made public by the Bureau of Mines, Department of Commerce, based on reports received from 62 operators in 19 states, and collected in cooperation with the geological surveys of Iowa, Kansas, Michigan, New York, Texas, Virginia and Washington. The quantity of gypsum mined in 1925 was 5,678,302 short tons, which is the largest output ever recorded and exceeds that of 1924 by more than 600,000 tons, or nearly 13%. The value of the sales of both crude and calcined gypsum was $47,893,573, an increase of more than $5,000,000, or 12%, compared with 1924. Over 1,000,000 tons was sold crude and 4,104,735 tons was sold calcined. The value of the gypsum sold crude was $2,823,229, or $2.78 per ton, and the value of that sold calcined was $45,070,344, or $10.98 per ton. New York is the largest producer of gypsum. The production of crude gypsum in that state in 1925 was 1,730,254 short tons—30% of the entire output—an increase of 17% compared with 1924. It was also the largest seller of crude and calcined gypsum, 354,394 tons of the former (or 35% of the total) and 1,193,520 tons of the latter (or 29% of the total) being marketed in New York in 1925. These were considerable increases over 1924. Other important states in the production of crude gypsum were: Iowa, 800,167 tons; Michigan, 649,053 tons; Texas, 558,132 tons, and Ohio, 551,479 tons. These five states reported nearly 76% of the total.

Crude and Calcined Gypsum Sold by Producers in the United States in 1925, by States

State—	No. of plants reporting	Total quantity mined Short tons	Sold crude — Short tons	Sold crude — Value	Sold calcined — Short tons	Sold calcined — Value	Total value
Iowa	7	800,167	140,451	$381,584	562,210	$6,352,687	$6,734,271
Kansas	3	166,952	52,869	126,886	87,656	882,624	1,009,510
Michigan	5	648,503	155,961	391,093	477,076	5,056,201	5,447,294
Nevada	6	350,130	31,471	57,073	259,693	1,664,736	1,721,809
New York	10	1,730,254	354,394	1,017,403	1,193,520	15,518,836	16,536,239
Ohio	3	551,479	11,423	32,818	540,504	6,361,314	6,394,132
Oklahoma	4	320,931	53,286	122,666	232,660	2,476,797	2,599,463
Texas	6	558,132	28,396	69,487	426,710	3,652,467	3,721,954
Other States[1]	18	551,204	185,884	624,219	324,706	3,104,682	3,728,901
	62	5,678,302	1,014,135	2,823,229	4,104,735	45,070,344	47,893,573

[1]Arizona, California, Colorado, Montana, New Mexico, Oregon, South Dakota, Utah, Virginia, Washington and Wyoming.

St. Joe Lime Plant Damaged by Fire

AN early moving fire recently damaged the larger part of the main plant of the St. Joe Lime and Stone Co., St. Joe, Ark. Loss on the plant was estimated at $15,000, covered by insurance, and damage to the new machinery recently installed in the new hydrating plant is said to be about $10,000. The fire is believed to have started from sparks from one of the kilns.

The company has been pushing work on additions to the crushing plant which will eventually double the capacity. The new hydrating plant which was damaged was just installed and not yet in operation. It is expected that work on rebuilding the burned portion of the plant and replacing the damaged machinery would begin at once. John O. Willson is president of the company and J. W. Tueschman, secretary-treasurer.—*Little Rock (Ark.) Democrat.*

Keystone Phosphate to Invade Foreign Markets

ACCORDING to Fred S. Irwin, manager of the Keystone Phosphate Co., Paris, Idaho, plans are now under way which, if completed, will result in the movement of 100,000 tons annually of rock phosphate from the company's mines in Idaho to European and Asiatic markets. Portland, Ore., will be the shipping point, the phosphate coming on cars to that place from Paris, Idaho. Negotiations are at present being carried on with Swiss buyers, it is said.

A lower rail rate from Idaho districts to Portland has been secured during the past few years, and Mr. Irwin and his associates are now interested in securing reduced freight rates in steamers so as to be able to put their phosphate in European markets in competition with that mined in other parts of the world.

Japan is a very probable market for some of the phosphate from the Keystone mines also, according to Mr. Irwin. He is cooperating with Harry L. Hudson, traffic manager of the Port of Portland, in trying to arrange the new schedule of shipping.

Illinois Shows Greatest Increase in Agstone Production

THE year 1925 marked a considerable increase in agricultural limestone production, as noted in the Bureau of Mines report published in the August 7 issue of ROCK PRODUCTS. A considerable part of this increase came from Illinois.

The table which follows was prepared by W. R. Sanborn of the Lehigh Stone Co., Kankakee, Ill. It shows that until 1925 the production of agricultural limestone was almost a constant tonnage in other parts of the United States except Illinois. In 1925 and (as estimated) in 1926 a gratifying increase has been shown in both the United States and Illinois production, but it is noted that the percentage produced in Illinois has considerably increased.

The logical deduction from these figures would seem to be that some "missionary work" that has been so effective in promoting the use of agricultural lime in Illinois might be well applied in other states.

AGRICULTURAL LIMESTONE PRODUCED IN ILLINOIS AND THE ENTIRE UNITED STATES, FOR YEARS 1919-1926

Compiled from Reports of U. S. Geological Survey. Showing what a factor Illinois has always been in this industry, and the steady growth, due in great measure to the liberal specification as to size permitted by the University of Illinois. Showing also the almost constant requirements of the balance of the country, and the big increase of 1925.

TONS PRODUCED

	Total U.S.	All except Illinois	Illinois	Illinois Pct. of T'l U.S.
1919	1,392,914	1,069,251	323,663	23%
1920	1,364,260	939,540	424,720	31%
1921	1,311,520	977,560	333,960	25%
1922	1,195,000	931,760	263,240	22%
1923	1,278,770	928,220	350,550	28%
1924	1,352,600	{ 939,850 / { 828,177	{ 412,750 / { †524,423	31% / 39%
1925	1,970,000	1,175,025	†794,975	40%
1926	*2,100,000	1,100,000	†1,000,000	47%

*Estimate based upon past performance.
†J. R. Bent's figures of tonnage used in Illinois. Note that in 1924 Illinois produced 412,750 tons and the farmers of Illinois bought and used 524,423 tons, indicating that about 110,000 tons used in Illinois are produced in Indiana, Wisconsin, Iowa and Missouri. Illinois increase for 1925 is 52% and the balance of the country increased 22%.

Talc Production in 1925

THE total quantity of talc mined in the United States and sold in 1925 was 182,256 short tons, valued at $2,011,793, according to a statement prepared by the Bureau of Mines, Department of Commerce, which was compiled from individual reports of producers. The figures comprise 5,684 short tons of crude talc, valued at $24,533; 895 tons of sawed and manufactured talc, valued at $107,691; and 175,677 tons of ground talc, valued at $1,879,569. They represent an increase in quantity of 2%, and a decrease in value of nearly 10%, as compared with 1924. There were 23 producers of talc in 1925, the same as in 1924.

Of the total quantity New York sold 85,109 short tons, valued at $933,913, as compared with 78,340 tons, valued at $1,162,488, in 1924; Vermont sold 54,883 short tons, valued at $533,603, as compared with 61,653 tons, valued at $573,747, in 1924; and California sold 14,883 short tons, valued at $194,975, as compared with 16,335 tons, valued at $247,799, in 1924. The remainder of the output was produced by Virginia, Pennsylvania, New Jersey, North Carolina, Maryland and Georgia.

Imports of talc for consumption in 1925 were 20,993 short tons, valued at $450,532. Corresponding figures for 1924 were 17,809 tons, valued at $342,355.

Mt. Shasta Silica Deposits

THE Mt. Shasta Silica Co. of San Francisco has completed a broad gauge railroad to its land, which will open about 9000 acres of diatomaceous earth deposits to exploitation.

Why More Cement Importation May Be Expected

WRITING in the *Iron Age*, E. C. Eckel, the author of "Cements, Limes and Plasters" and other well known books relative to the cement industry, discusses the European situation as it affects the exporting of cement to the United States. Mr. Eckel finds five reasons why cement may be cheaply shipped from European countries, namely:

1. Low ocean freights.
2. Low European water freights.
3. An abnormally low European wage level.
4. Low European overhead costs.
5. Cheap handling of European export trade.

Discussing these, he says it will be at least 10 years before the excess tonnage built during the war dies down to actual requirements, and during this time ocean freights will be low. Water freights on European canals or canalized rivers are very low, especially now that wages are paid in depreciated currency in such countries as France and Belgium.

Summing up the freight situation, he says that from $4 to $5 per ton will carry heavy freight such as cement from any producing point in western Europe to any north Atlantic port.

Wages, as everyone knows, are abnormally low in continental Europe. Mr. Eckel says workers in cement plants are paid from 60c to 80c per day. With the high cost and high standard of living that has followed the war, such a low wage would not be tolerated in America and a series of strikes would raise the general wage level. But in continental Europe the trades unions do not concentrate on obtaining better wages and working conditions. They fritter away their efforts in political action and social theory.

As to superintendence he points out that a chemist may be had for about $40 a month and a technically trained manager of a large mill gets only $130 a month—and thinks he is better treated than most.

High taxation handicaps production somewhat heavily in continental Europe, but other overhead expenses are low. Mills can be built for two-thirds the American cost. Sales cost is lower because of lower salaries.

In closing Mr. Eckel said:

"Possible methods of meeting this competition are:

(1) Abandonment of our coast markets.

(2) Lowering prices in the coast markets to meet foreign competition.

(3) Buying the foreign output for account of an American pool.

(4) Building mills abroad.

"Of these methods one and possibly two, requiring concerted action, are probably illegal. My own feeling is that the particular companies which feel the competition most keenly are likely to try the fourth method finally, when they become convinced that foreign competition is here to stay for a time."

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

CENTRAL FREIGHT ASSOCIATION DOCKET

13797. **Crushed or ground magnesite,** carloads, Joliet, Ill., to Canton, O. Present rate, 25c; proposed, 420c per net ton.

13801. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Lafayette, Ind., to Normal, Ill. Present rate, 6th class; proposed, 101c per ton of 2000 lb.

13806. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Pendleton, Ind., to Lebanon, Ind. Present rate, 6th class; proposed, 86c per net ton.

13823. **Crushed Stone,** carloads, Spore, O., to Detroit, Mich. Present rate, 6th class; proposed, 105c per net ton.

13820. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Leeland, Ind., to Gary, Ind. (B. & O. R. R. delivery). Present rate, 75c per net ton; proposed, 70c per net ton.

13826. To make the following revision in rates on **sand,** viz., blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, between points in Central Freight Association territory:

To establish to Milwaukee, Wis., rate of 267c per net ton from Cincinnati, O., and 292c per net ton from points in Ashland (Ky.) group. Present rate, 292c and 353c per net ton.

13828. **Crushed stone,** carloads, East Liberty, O., to Sunbury, O. Present rate, 6th class; proposed, 90c per net ton.

13829. **Crushed stone,** carloads, Maple Grove, O., to Carrollton, Oneida and Sherrodsville, O. Present rates, 6th class rates of 18c to Carrollton and 17c to Oneida and Sherrodsville; proposed, 120c per net ton.

13830. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Merom and Riverton, Ind., also Palestine, Ill., to West Lebanon, Ind., Alvin, Henning, Rantoul, Le Roy, Pana, Ramsey and Monticello, Ill. Present rates, 126c per net ton to Henning, Rantoul, Monticello, Pana and Ramsey, Ill., and 139c per net ton to Alvin and Le Roy, Ill., also West Lebanon, Ind.; proposed, 113c per ton of 2000 lb. to West Lebanon, Ind., and Albin, Henning, Rantoul, Le Roy, Pana and Ramsey, Ill., and 114c per ton of 2000 lb. to Monticello, Ill.

13838. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, from Lafayette and Lundee, Ind., to Decatur, Ind. Present rate, 135c per net ton from Lafayette and 6th class from Dundee; proposed, 113c from Lafayette, Ind., and 90c per ton of 2000 lb. from Dundee, Ind.

13844. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Massillon and Navarre, O., to Belleville, O. Present rate, 120c per net ton (Mt. Vernon rate); proposed, 115c per net ton.

13850. **Crushed stone,** in bulk in open top cars, carloads, Marble Cliff, O., to various stations in Ohio (in cents per net ton):

To—	Pres.	Prop.
Galena	70	60
Sudbury	70	60
Condit	70	60
Centerburg	70	60
Mt. Vernon	70	60
Howard	80	70
Danville	80	70
Brinkhaven	80	70
Glenmont	90	70
Millersburg	90	70
Fredericksburg	90	70
Orrville	90	70
Warwick	100	80
Akron	100	80
Cuyahoga Falls	100	80
Hudson	.....	90

13854. **Gravel and sand,** carloads, Fair Oaks, O., to Cambridge, O. Present rate, 80c per net ton; proposed, 70c per net ton.

13855. **Crushed stone,** in bulk in open top cars, carloads, Marble Cliff, O., to Cincinnati, O. Present rate, 90c per net ton; proposed, 80c per net ton.

13856. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Kern, Ind., to Crawfordsville, Ind. Present rate, 76c per net ton; proposed, 70c per net ton.

13865. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Wolcottville, Ind., to Huntington, Ind. Present rate, 104c per net ton; proposed, 90c per net ton.

13866. **Crushed stone,** carloads, Sandusky, Marblehead, Martin and Genoa, O., to Oak Harbor O. Present rate, 60c per net ton; proposed, 50c per net ton.

13878. **Sand and gravel,** carloads, Mechanicsburg Gravel Pit, O., to Akron, O. (A. C. & Y. Ry. delivery). Present rate, 6th class; proposed, 95c per net ton.

SOUTHWESTERN FREIGHT BUREAU DOCKET

9350. **Sand,** from points in Kansas to Amarillo, Tex. To establish a rate of 9c per 100 lb. on sand, carloads, minimum weight marked capacity of car, except when loaded to full visible capacity, actual weight, but not less than 50,000 lb., will govern, from Arkansas City, Wichita, Mulvane and Oxford, Kan., to Amarillo, Tex.

Shippers advise there is a considerable demand for their higher grades of sand at Amarillo, account the sand produced at that point is an inferior grade, but that they are unable to secure any of the business on a rate higher than 9c per 100 lb.

9379. **Lime** from points in Missouri to points in Wisconsin. To establish the following rates in cents per 100 lb. on lime, carloads, from Mosher and Ste. Genevieve, Mo., to points in Wisconsin shown below:

From Mosher and Ste. Genevieve, Mo.

To Wisconsin points:

	Rates Min.wt. 30,000		Rates Min.wt. 30,000
Allenton	23	Neenah	23
Amherst	23½	Nekoosa	23½
Amherst Jct.	23½	N. Fond du Lac	23
Appleton	23	Oshkosh	23
Arpin	23½	Portage	23½
Auburndale	23½	Port Edwards	23½
Bancroft	23½	Readfield	23½
Dale	23½	St. Johns	23
Fond du Lac	23	Sheridan	23½
Fremont	23½	Sherry	23½
Hamilton	23	Sherwood	23
Hewitt	23½	Slinger	23
High Cliff	23	State Hospital	23
Hilbert Jct.	23	Stevens Point	23½
Junction City	23½	Stockton	23½
Klings Spur	23½	Theresa	23
Lomina	23	Vandyne	23
Madison	23½	Vesper	23½
Marshfield	23½	Waupaca	23½
Medina Jct.	23½	West Bend	22½
Menasha	23	Weyanwega	23½
Milladore	23½	Wisconsin Rapids	23½

To same points, minimum weight 40,000 lb., 21c per 100 lb.

The recommended changes in the proposals are necessary to correct errors.

It has been suggested in connection with this proposal, as in connection with some others, that there should be a general revision of the lime rates to Wisconsin destination on a basis somewhat higher than that prescribed by the Interstate Commerce Commission in Lehigh Lime Co. Case, Dkt. 13014, 85 I. C. C. 341, for observance from Mitchell, Ind., to C. F. A. points.

SOUTHERN FREIGHT ASSOCIATION DOCKET

28422. **Crushed marble and stone,** from Whitestone, Ga., to Atlanta, Ga. (when for beyond) (interstate). In lieu of present combination rate of 415c per net ton, it is proposed to establish commodity rate of 99c per net ton on marble and/or stone, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Whitestone, Ga., to Atlanta, Ga. (when for beyond) (interstate). Proposed rate made with relation to current rate from Tate, Ga.

28423. **Sand,** from Manchester, Ala., to Birmingham (Ala.) group points. In lieu of Jasper, Ala., combination rate of 150c per ton, it is proposed to establish rate of 95c per net ton on sand, carloads, minimum weight 40,000 lb., from Manchester, Ala., to Birmingham, Bessemer, Ensley, Thomas, Pratt City and Woodward, Ala., made in line, distance considered, with rates in effect from Cordova, Jackson's Lake, Montgomery, Ala., and Goldens, Miss., to Birmingham, Ala.

28484. **Crushed, ground or pulverized stone,** marble, slate, etc., from Southern points to points in Illinois and Wisconsin. It is proposed to establish through commodity rates on crushed, ground or pulverized stone, marble or slate, etc., from quarries in Alabama, Georgia and Tennessee to points in Illinois and Wisconsin, to apply in lieu of combination rates; also to revise the present through commodity rates to be on a relative basis. Statement of present rates, as well as proposed rates and basis therefor, will be furnished upon request.

28486. **Sand,** from specified L. & N. R. R. stations to New Orleans, La. It is proposed to establish reduced rate of 198c per net ton on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from the following L. & N. R. R., S. & N. A. Division and M. & M. Division stations, viz., Coosada, Oktamulke, Prattville Junction, Jackson's Lake, Montgomery, McGehees, Cloverfield and Tyson, Ala., to New Orleans, La. Proposed rate same as recently established from Cooks Springs, Ala.

28519. **Sand,** from Spruce Pine, Ala., to Nashville, Tenn. In lieu of lowest combination rate, it is proposed to establish rate of 158c per net ton on sand (washed or unwashed), carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Spruce Pine, Ala., to Nashville, Tenn., made on basis of carriers' proposed Georgia scale, less 10%.

28522. **Gravel,** from Nashville, Tenn., to Cades and Kerrville, Tenn. No through rates in effect, and it is proposed to establish the following rates on gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern. (If the carrier, for its own convenience, furnishes a car of greater capacity than ordered, the carload minimum weight will be that applicable for the size car ordered, except that no order will be accepted from the shipper for cars of less than 60,000-lb. stenciled capacity. If a larger car than ordered is furnished, the following notation must be made by the Agent on the bill of lading and way bill, "Car ..... lb., stenciled capacity ordered by shipper on ..... date)" from Nashville, Tenn., to Cades, Ky., 143c; Kerrville, Tenn., 151c per net ton. Proposed rates are same as proposed under submittal 28409 on crushed stone from Mimms, Tenn., to these destinations.

28526. **Crushed stone** and pulverized limestone, from Whitestone, Ga., to Chipley, Marianna and Crestview, Fla. In lieu of lowest combination rates, it is proposed to establish the following through rates from Whitestone, Ga.: On stone or slate, crushed or broken, carloads, to Crestview, Fla., 292c per net ton. On limestone, pulverized, carloads, to Chipley and Marianna, Fla., 306c per net ton. The proposed rates to be subject to minimum weight of 90% of marked capacity of car, except when cars are loaded to their full visible capacity, actual weight shall govern. The rates suggested are those formerly in effect and which were canceled on the obsolete theory.

28553. **Crushed stone,** from Blankenbakers, Frankfort and Louisville, Ky., to Simpsonville and Scotts, Ky., and intermediate L. & N. R. R. stations. It is proposed to establish the following reduced rates on stone, crushed, carloads, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern: From Blankenbakers, Ky., to Scotts, Ky., 72c; to Simpsonville, Ky., 68c per net ton; from Frankfort, Ky., to Scotts, 68c; to Simpsonville, 72c per net ton; from Louisville, Ky., to Scotts, 72c; to Simpsonville, 68c per net ton. The proposed rates to be observed as maximum at intermediate points to Scotts or Simpsonville, as the case may be.

28568. **Stone,** crushed, ground or pulverized, from quarries in Alabama, Georgia and Tennessee to Ohio River crossings and C. F. A. points. It is proposed to establish through commodity rates on crushed, ground or pulverized stone from quarries in Alabama, Georgia and Tennessee to Ohio River crossings and to C. F. A. points to apply in lieu of combination rates; also to revise the present through rates to be on a relative basis. Statement of present and proposed rates, with

basis for the suggested rates, will be furnished upon request.

28610. **Limestone**, from Ladds, Ga., to L. & N. R. R. stations. In lieu of combination rates, it is proposed to establish rates on limestone, ground or pulverized, carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Ladds, Ga., to L. & N. R. R. stations: Nashville and Decatur Division; Lewisburg Division; South and North Alabama Division; Mobile & Montgomery Division; New Orleans and Mobile Division; Atlanta Division (New Line); Atlanta Division (Old Line); Knoxville Division, and branches; on basis of proposed Georgia Joint Line scale, reduced 10%. Statement of proposed rates will be furnished upon request.

TRANSCONTINENTAL FREIGHT BUREAU DOCKET

7072. **Crushed oyster shells**, carloads, waybilled: Request for rate of 60c per 100 lb., minimum weight 80,000 lb., on crushed oyster shells, from Morgan City, La., to Pacific Coast points under Tariffs 1Z (I. C. C. Nos. 56, A166, 1748 and 1166 of Frank Van Ummersen, H. Wilson, B. T. Jones and H. G. Toll, Agents, respectively) and 4W (I. C. C. Nos. 57, A165, 1746 and 1167 of Frank Van Ummersen, H. Wilson, B. T. Jones and H. G. Toll, Agents, respectively).

7075. **Phosphate rock**, carloads, way billed; request for proportional rate of 81c per 100 lb., on phosphate rock from Evansville, Ind., to Pacific Coast points, under Tariffs 1-Z (I. C. C. 56, A166, 1748 and 1166 of Frank Van Ummersen, B. T. Jones, W. Wilson and H. G. Toll, agents, respectively) and 4W (I. C. C. 57, A165, 1746 and 1167 of Frank Van Ummersen, H. Wilson, B. T. Jones and H. G. Toll, agents, respectively) applicable only on traffic originating in the Mt. Pleasant, Tenn., district.

ILLINOIS FREIGHT ASSOCIATION DOCKET

3145-A. **Sand and gravel**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full visible capacity, actual weight will apply, from Dubuque, Iowa, to Galena to Polo, Ill., inclusive. Rates in cents per net ton to (representative points): Galena, Ill., present 81c, proposed 75c; Savanna, Ill., present 90c, proposed 80c; Daggets, Ill., present 95c, proposed 85c; Polo, Ill., present $1, proposed 96c.

228A. **Sand**, carloads, from Utica, Ill., to La Salle, Ill. (rates per net ton). Present, 63c; proposed, *50c. *To apply only on sand shipped in private line cars owned by consignee, and to apply only on Illinois intrastate traffic.

3069-A. **Silica sand**, carloads, minimum weight 90% of marked capacity of car, except when loaded to full visible capacity actual weight will apply, but not less than 40,000 lb., from Wedron, Ill., Millington, Ill., Ottawa, Ill., to Springfield, Ill. Present rate, 150c; proposed, 140c.

3781. **Agricultural limestone**, carloads, minimum weight 90% of marked capacity of car, except when loaded to full visible capacity actual weight will apply. From Cordova, Ill.:

(Representative points)

To—	Pres.	Prop.
Adrian, Ill.	134	123
Augusta, Ill.	134	123
Basco, Ill.	146	127
Carthage, Ill.	134	123

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

10710. **Flint rock, quartz rock and crude feldspar, carloads**, minimum weight 60,000 lb., from Maine Central R. R. stations, Bath, Bowdoinham, Buckfield, Cathance, East Hebron and Topsham, Me., and Grand Trunk Ry. stations, Bates, Littlefield, Locke's Mills and South Paris, Me., to Still River and Manchester, Conn., 19c via B. & M. R. R. and N. Y. N. H. & H. R. R. Reason—To establish rate not in excess of the current rate to Trenton, N. J.

10725. **Limestone**, ground, carloads, minimum weight marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from West Stockbridge, Mass., to Jersey City and Grasselli, N. J., 16 via N. Y. N. H. & H.-Communipaw, N. J.-C. R. R. of N. J. Reason—To permit movement of traffic which is not possible under present rates.

10740. **Limestone**, carloads, minimum weight 40,000 lb., from Cheshire, Farnams, North Adams, Renfrew, Richmond and Zylonite, Mass., to Baltimore, Md., 25c, via B. & A. R. R., Chatham, N. Y., Selkirk Jct., N. Y., or Rensselaer, N. Y., N. Y. C. R. R., 60th St., N. Y., and Penn. R. R. to destination, or via Albany, N. Y., D. & H. Co., Wilkes-Barre, Pa., and Penn. R. R. to destination. Reason—To place B. & A. R. R. limestone shippers on an equality with Rutland R. R. shippers.

10758. **Crushed stone**, carloads, minimum weight 60,000 lb., from West Dummerston, Vt., to Brattleboro, Vt., 50c per ton of 2000 lb., via C. V. Ry. (local). Reason—To meet motor truck competition.

WESTERN TRUNK LINE DOCKET

5609. **Lime**, common, hydrated, quick or slaked, from Chicago, Ill., when originating at Woodville, O., to Denver, Colo., etc. Present rate, 34½c; proposed, 33½c, minimum weight 40,000 lb. Present rate, 40½c; proposed, 40c, minimum weight 30,000 lb.

5203A. **Lime**, carloads, from Chicago, Ill., to Sturgeon Bay, Wis. Present, class rate; proposed, 14½c per 100 lb. Minimum weight 40,000 lb.

5626. **Sand, silica**, carloads, from Ottawa, Ill., to Richmond, Ind. Present, $2.90 per net ton; proposed, $2.39 per net ton. (By shipper.)

TRUNK LINE ASSOCIATION DOCKET

13664. To revise the rate on **limestone, unburnt**, ground or pulverized, carloads, minimum weight 50,000 lb., from Baltimore & Ohio R. R. lime kilns to points on the B. & O. R. R. in West Virginia south of Clarksburg and Grafton, W. Va., rates ranging from $2.36 to $3.26 per ton of 2000 lb.

Reason—Proposed rates are the same as the mileage scale authorized between B. & O. R. R. stations in West Virginia, and shippers have requested same measure of rates on interstate traffic as authorized on West Virginia traffic. File 41605.

13688. **Fluxing limestone**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Bellefonte and Pleasant Gap, Pa., to Newark, N. J., stations, $2.65 per 2240 lb. (Subject to Rule 77.) Reason—To establish rate which will be in harmony with that in force from other limestone shipping points to points in the same general territory. File 41671.

13693. **Lime, agricultural, chemical**, gas, glass or land, carloads, also ground limestone, carloads, minimum weight 30,000 lb., except on ground limestone 50,000 lb., from Bellefonte and Pleasant Gap, Pa., to Ore Valley to Red Lion, Pa., (A) 13½c, (B) 13c; Springvale to Muddy Creek Forks, Pa., (A) 15c, (B) 14½c; Bruce, Pa., to Cardiff, Md., (A) 16c, (B) 15½c; Whiteford, Md., to Loch Haven, Md., (A) 17c, (B) 16½c; Oakleigh to Evergreen, Md., (A) 17c, (B) 16c per 100 lb. Reason—Establish rates which will be comparable with others from and to the same territory. File 41670.

13759. **Crushed stone**, carloads, minimum weight 90% of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, to Cordova, Md., from Chickies, Bullmeyer, Bainbridge and Rheems, Pa., $1.60 per 2000 lb., and from Ernest and DeKalb St., Norristown, Pa., $1.50 per 2000 lb. (subject to Rule 77). Reason—Proposed rates are based on mileage scale prescribed by the I. C. C., in Dockets 9389 and 9532. File 41941.

13762. **Stone chips** and dust, carloads, minimum weight 90% of marked capacity of car, except when loaded to cubical or visible capacity, actual weight will apply, from De Kalb Jct., N. Y., to Camden, N. J., Altoona and Johnstown, Pa., $4.95 per net ton. Reason—Proposed rate compares favorably with present rate on same traffic from De Kalb Jct., to Hackensack, N. J.

13765. To cancel commodity rate of $1.75 per ton on **crushed stone**, from Cumberland, Md., to Fayette City, Pa., as published in Item 3860 of Agent Wilson's I. C. C. A157, classification basis to apply. Reason—Investigation develops there is no movement and rate has become obsolete. File 10426.

13773. Amend Reading Co. Tariff I. C. C. 6, applying on lime, building and hydrated building, also land, chemical and hydrated chemical, from Reading Co. points to destinations on the Erie R. R. and subsidiary lines, by reducing the minimum weight from 40,000 to 30,000 lb., no change in rates being involved. Reason—Equalize the minimum weight to points on the Erie R. R. with that via other routes. File 41912.

Southern Sand Scale

IN a proposed report on No. 17517, rates on chert, clay, sand and gravel within the state of Georgia, and the cases joined with it, Examiner E. H. Waters has proposed the making of state and interstate rates according to scale in a large part of the Southeast, one of the results of which will be the destruction of rates ordered by the Georgia Commission, the grant of arbitraries over the uniform scale for the benefit of short and weak lines, the special treatment of the Florida peninsular, and higher rates on slag, from Copperhill, Tenn., to points in Georgia, but not so high as those proposed by the carriers. The report also covers No. 17699, Roquemore Gravel Co. et al. vs. Atlanta, Birmingham & Atlantic et al.; No. 17699 (Sub. No. 1) Same vs. Same; No. 17689, Same vs. Atlanta, Birmingham & Atlantic et al.; No. 17763, Roquemore Gravel Co. et al. vs. Atlanta, Birmingham & Atlantic et al.; No. 17764, Dixie Sand & Gravel Co. vs. A. B. & A. et al., a Sub. No. thereunder, Same vs. A. B. & A. et al.; and I. and S. 2470, Sand, Gravel and Slag from Alabama and Tennessee to points in Georgia.

The title complaint was instituted by the Commission up on a petition filed on behalf of the Atlantic Coast Line and eight short line carriers operating in Georgia to determine whether the present rate on chert, clay, sand and gravel and other allied commodities required by the Georgia Public Service Commission by its order of February 25, 1925, to be maintained for intrastate movements between points in Georgia resulted in any undue or unreasonable advantage, preference or prejudice as between persons or localities in intrastate commerce, on the one hand, and interstate or foreign commerce on the other, or any undue, unreasonable, or unjust discrimination against interstate or foreign commerce; and if so, what rates or what maximum and minimum should be prescribed as a cure. The investigation and suspension docket was created by schedules filled with the view to relieving the situation. When these cases were heard the only issues remaining for determination in the suspension case, the examiner said, involved the propriety of schedules proposing increases on slag from Copperhill to points in Georgia.

The examiner said the record shows keen competition in the sale and production of the commodities considered and called for a consideration of the rates throughout a substantial part of southern territory. The action of the Georgia Commission caused the filing of the formal complaints embraced within this docket. The Georgia scales were all subject to a minimum of 60,000 lb. but those on stone, granite (crushed), flagging, rubble or stone screenings, and on washed gravel, and slag were made 10 cents per ton higher than on chert, clay, unwashed gravel, sand and shale.

In his recommendation, Examiner Waters said no distinction should be made between the various materials. Four scales were submitted, each lower for the initial five miles than the 50 cent per ton initial rate carried by the Georgia scale. Rates of progression, however, brought about variations as high as 21 cents per ton at the 150-mile distance. At that distance the carriers' scale made a rate of 131 cents. The Georgia scale for that distance is 120 cents. The complainant's proposed rate at that distance was 110 cents and the scale known as the Brooker scale produced 115 cents.

In summing up, the examiner said the evidence in these proceedings justified the conclusion that there were no such differences in transportation conditions over standard lines between the points in the territory here considered as to warrant differences in the rate level with the single exception of the Florida Peninsula, and that the Commission could so find. He recommended making rates for the Florida Peninsula by the method approved in the Southern Class Rate Investigation, 100 I.C.C. 513, and 109 I.C.C. 300, that is, by the fixing of arbitraries to be added to the basic scale for that part of the haul within Florida south of the Seaboard Air Line from Jacksonville to River Junction, Fla. He said that in the class rate case mentioned the Commission condemned the method of making rates to and from the Florida Peninsula on the Jacksonville combination. He recommended that that method also be disapproved in these proceedings.

The American Short Line Railroad Association presented a list of short lines for which a special basis of rates was sought. No objection, the examiner said, was made to according the short lines special treatment. He said that the special treatment for short lines should, however, not be limited to the list submitted by the association, but should be extended to any that might show that they were entitled to such consideration. The examiner's recommendations in regard to the formal docket cases are as follows:

The Commission should find that the rates maintained by the defendants on sand (washed or unwashed), gravel (washed or unwashed) and clay gravel, in straight or mixed carloads, from Montgomery and Chattanooga to points in the destination territory involved in the complaints, and that the rates maintained by respondents in No. 17517, for the interstate transportation of the commodities therein involved, in straight or mixed carloads, between points in the state of Georgia, and between points in the state of Georgia and other points in the states in southern territory are, and for the future will be, unreasonable to the extent that they exceed rates set forth in the following tables, subject to a minimum weight of 90% of the marked capacity of the car, except when car is loaded to full visible capacity actual weight shall govern:

TABLE A

Distance scales for interstate application over standard or trunk lines except to and from points in Florida peninsula south of the Seaboard Air Line from Jacksonville to River Junction, Fla. Rates in cents per net ton.

Distance	Single line rates Cents	Joint-line rates Cents
10 miles and under	55	65
20 miles and over 10	55	70
30 miles and over 20	60	75
40 miles and over 30	70	85
60 miles and over 40	80	95
80 miles and over 60	90	105
100 miles and over 80	100	115
125 miles and over 100	110	125
150 miles and over 125	120	135
175 miles and over 150	130	140
200 miles and over 175	135	145
230 miles and over 200	140	150
260 miles and over 230	150	160
290 miles and over 260	160	170
320 miles and over 290	165	175
360 miles and over 320	175	180
400 miles and over 360	185	190
440 miles and over 400	195	200
480 miles and over 440	205	210
520 miles and over 480	215	215
560 miles and over 520	225	225
600 miles and over 560	235	235
650 miles and over 600	245	245
700 miles and over 650	255	255
750 miles and over 700	265	265
800 miles and over 750	275	275

TABLE B

Interstate rates for either single or joint-line transportation over standard or trunk lines to and from destinations in Florida south of the Seaboard Air Line from Jacksonville to River Junction, Fla., to be determined by adding to the rates under the basic distance scales set forth in Table A the following arbitaries for distances south of said line. Arbitraries are in cents per net ton.

	Arbitrary
30 miles and under	15
60 miles and over 30	20
100 miles and over 30	25
140 miles and over 100	30
180 miles and over 140	35
220 miles and over 180	40
300 miles and over 220	45
380 miles and over 300	50
500 miles and over 380	55

TABLE C

When either of the so-called short lines shown in Appendix B participate in the movement, rates are to be determined as follows:

Apply the rates applicable under appropriate scale or scales above set forth, plus the following arbitrary which is to accrue solely to the short line:

Arbitrary, 25 cents per net ton.

The Commission should further find that the rates maintained by defendants in Nos. 17699, 17699 (Sub. No. 1), 17764 and 17764 (Sub. No. 1), on sand (washed or unwashed), gravel (washed or unwashed), and clay gravel, in straight or mixed carloads, from Montgomery and Chattanooga to destinations in Georgia, Florida and Mississippi are, and for the future will be, unduly prejudicial to complainants at Montgomery and Chattnooga, and unduly preferential of shippers of slag, in carloads, from Birmingham, Gadsden, Anniston and other slag-producing points in northern Alabama, and from Copperhill, Tenn., to the extent that they exceed, distance considered, the rates contemporaneously maintained by said defendants on slag, in carloads, from the points last mentioned to the same destinations, subject to the application of the rates under the scales above set forth as maximum rates.

The Commission should further find that the rate of 79 cents maintained by the Atlanta, Birmingham & Atlantic and the Central of Georgia on sand from points in the Junction City (Ga.) district, enumerated in No. 17689, to Birmingham, Ala., will be unreasonably low for the future and that reasonable rates for the future will be those computed under the basic distance scales set forth in Table A.

In applying the rates herein proposed to the longer hauls the carriers should be permitted, for the purposes of tariff simplification, subject to the Commission's approval, to use groups of modern extent, and measure the rates by distances to and from fairly representative points in such groups. In determining whether hauls are single-line or joint-line, carriers under common control or management shall be regarded as one line. All of the defendants and respondents should be classed as standard lines for the purposes of these findings, except those short lines for which special rate treatment is herein recommended.

In the supplemental report in Southern Class Rate Investigation, 109 I. C. C. 300, 312, the Commission sanctioned a certain rule for computing distances in southern territory for the application of the distance scales approved in that proceeding. Hence, it is recommended that the same rule for computing distances be used in connection with the scales herein prescribed as is finally determined in connection with the class rates approved in the Southern Class Rate Investigation, supra.

It is recommended that the following fourth-section relief be granted and to continue for a period of 90 days from the establishment of the rates found reasonable in this report for application between the points here involved, provided that where specific applications for permission to continue anv of the said rates for a longer period than 90 days shall have been filed within the period of 60 days from the establishment of said rates found reasonable such rates may be continued until the said applications shall have been determined:

(1) Carriers herein having circuitous routes from and to competitive points be authorized to establish and maintain the lowest rates prescribed for the transportation of the above described commodities, as maximum rates over any line or route between said points, and to maintain higher rates from, to, and between said intermediate points, provided that the rates from, to, and between said intermediate points shall not exceed the scale of rates prescribed in the report as maximum rates for application at such intermediate points, and shall in no case exceed the lowest available combination.

(2) That the short-line defendants, named in Appendix B, be authorized to establish and maintain rates for the transportation of the said commodities between junction points on their lines and points in the territory here considered the same as the rates contemporaneously maintained on like traffic between the same points by their standard-line competitors, and to maintain higher rates from and to intermediate points on the said short lines; provided that rates at the said intermediate points shall in no case exceed the rates prescribed in the report plus a differential of 25 cents per net ton, and shall in no case exceed the lowest available combination.

As to the proposed slag rates, the examiner said the Commission should find that they had not been justified and should order their cancellation without prejudice to the right of the Louisville & Nashville to establish rates on slag from Copperhill on the basis of the standard single-line basic scale of rates proposed in the formal complaint cases.

As to the Georgia rates, the examiner said the Commission should find that the maintenance of intrastate rates in Georgia lower than the corresponding rates proposed by him would result in unjust discrimination against interstate commerce and in undue prejudice to persons and localities in interstate commerce.

Waters said no order should be entered in the title complaint at this time. He said it was felt that the Georgia Commission would cooperate in authorizing such revisions as might be necessary to bring Georgia rates into harmony with the interstate adjustment.

Formal docket No. 17763 alleged, among other things, that the rates maintained by the railroads therein named on sand and gravel from Montgomery and Chattanooga to destinations in Mississippi were unreasonable and unduly prejudicial in favor of intrastate shippers of the like commodities between points in the Mississippi. Waters said the reasonableness of the interstate rates to Mississippi points, in so far as involved, had been considered. He said the evidence in this formal docket case showed that complainants did not ship sand and gravel into Mississippi and also that it failed to show that the intrastate rates in Mississippi had prevented such movement. He said the record warranted the conclusion and the Commission should so find that the intrastate rates on sand and gravel within Mississippi had not been shown to have been or to be unduly prejudicial to the complainants.

Lime Overcharges Found on Tennessee Shipments

A FINDING of overcharges and a direction to refund them have been proposed by Examiner J. C. Harraman, in No. 17051, Traffic Bureau of Knoxville et al. vs. Southern Railway et al., as to rates and charges on lime, from Knoxville, Tenn., to Braithwaite, La. By applying the rule in the Sligo Store case, he said, the Interstate Commerce Commission should find the correct rate was $3.93 instead of $4.33, the rate collected.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Able to Meet Strong Competition

Products Plant of V. Paturzo and Bro. Succeeds in Baltimore Clay-Brick District

THE plant of V. Paturzo and Bro., which is at 8th St. and the Pennsylvania R. R., Baltimore, Md., is one that is of unusual interest to the whole cement products industry. This is because it illustrates how it is possible for such an enterprise to grow in the face of the strongest kind of competition from other materials, for the plant is almost surrounded by clay brick producers. Another reason is that it is typical of those operations which have grown great from small beginnings. The small wooden shed which housed the original business stands in the yard of the present plant and covers perhaps 5% of the building space now required for the company's activities.

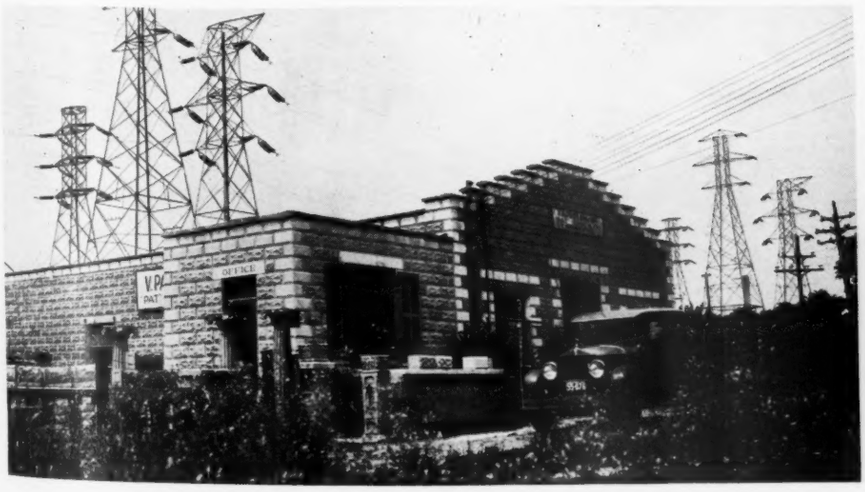
The main production of this establishment is that of concrete blocks of the standard sizes, which are made on an Ideal automatic tamper machine driven by a Wagner 10-hp. motor. A. F. Paturzo said that when the company decided to increase its capacity and build its present plant a very thorough study was made of the various concrete block machines in use in this country and Europe. From these the Ideal was chosen because of its simple construction and the accessibility of parts that might need repairs. The machine has proven so satisfactory that other Ideal equipment for making special shapes and the like has been abundantly installed and many thousand dollars worth of Ideal machinery is running in the plant today.

Well made decorative pieces

The aggregates used are mainly purchased from the Arundel Corp. of Baltimore, although some of them are bought from a local pit. The local sand contains a little clay and the clay has been looked upon as an advantage, as it was thought to decrease the permeability of the block. Experiments with hydrated lime are contemplated to see if even more impermeable block may be made by the addition of this material.

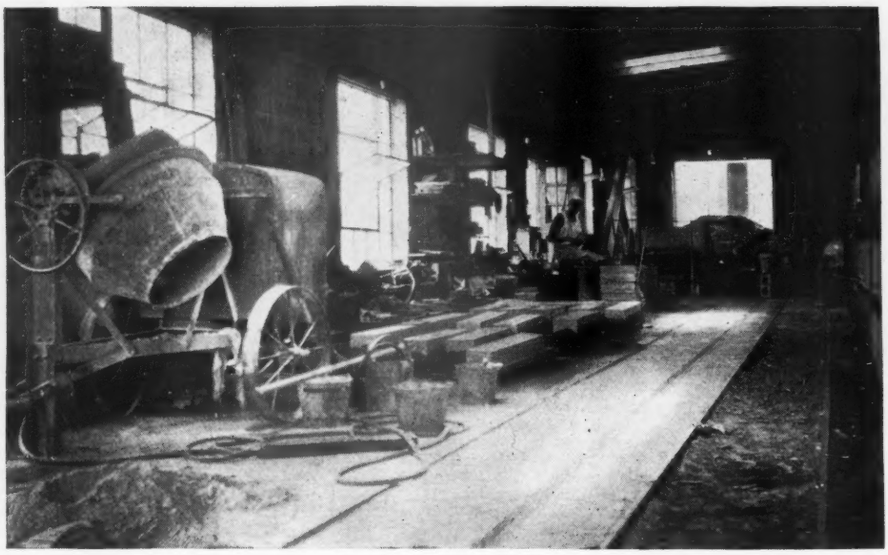
The importance of making block which rain could not penetrate has been recognized by the company, as it sells a great many faced block which are used without any surface covering, such as stucco. These block are now waterproofed with Medusa waterproofing compound and guaranteed to be waterproof, so far as penetration from ordinary rains is concerned.

Aggregate and cement are given the usual wet and dry mix and wheeled up a plank from a wheelbarrow and dumped into the receiving hopper of the block machine. From this the concrete goes by chain and bucket elevator to the feed hopper under which is an automatic feeder set to deliver the right



Plant substantially built of its own product

Stucco block and specials



One work room in products plant of V. Paturzo and Bro.

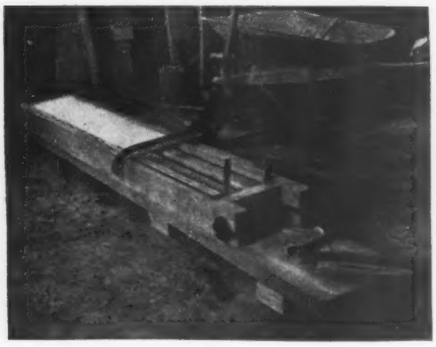
amount of concrete for one block. After tamping the power scraper and finisher is run forward and the way of throwing this into and out of operation is by an unusual mechanical device. A manila rope is hung so that a pull throws it over a revolving pulley and this starts the scraper forward. When the scraper has completed its work the rope is automatically thrown off and hangs loose until the next block is to be scraped.

The method of handling aggregate and mixed concrete by wheelbarrow and inclined planes was adopted after consideration had been given to other methods and it was judged on the whole that this would be the cheapest and the best for the conditions at this plant.

This company makes a great many special shapes adapted to construction in Baltimore, which is a town in which many "row houses" are built. Floor slabs and "jumps," on which joints in row houses rest, are popular shapes and so are chimney caps of various sizes. All these are made on Ideal hand machines, some of which have been especially built for the Paturzo plant.

Curing of blocks is in steam rooms of the ordinary type. Steam is furnished from a very neat boiler installation, all parts exposed to the air being well insulated with asbestor and magnesia coverings.

A large amount of trim stone, lintels, sills, coping and the like is made at this plant. A separate wing is provided for this with plenty of space for curing and storing. Most of this trim stuff is made in wooden molds. Steel molds were used at first, but the wooden molds were found lighter and easier to turn and handle.



Form for sills and lintels

A. F. Paturzo

Concrete Units Described in New Publication of Bureau of Standards

WHILE concrete units have long been used in building construction, it is only within the past few years that the manufacture of concrete brick, block and tile has attained a rapid growth. This growth has been brought about largely by the heavy demand for building materials and the efforts of interested associations in bringing to the attention of the public the desirable features of concrete units.

Numerous inquiries are received at the Bureau of Standards of the Commerce Department from people who are interested in learning more of the properties of concrete units and the details of the manufacturing methods. In order to answer these questions in a reasonably complete manner, a circular has been prepared covering the essential features of concrete brick, block and building tile, and giving some general information about their manufacture.

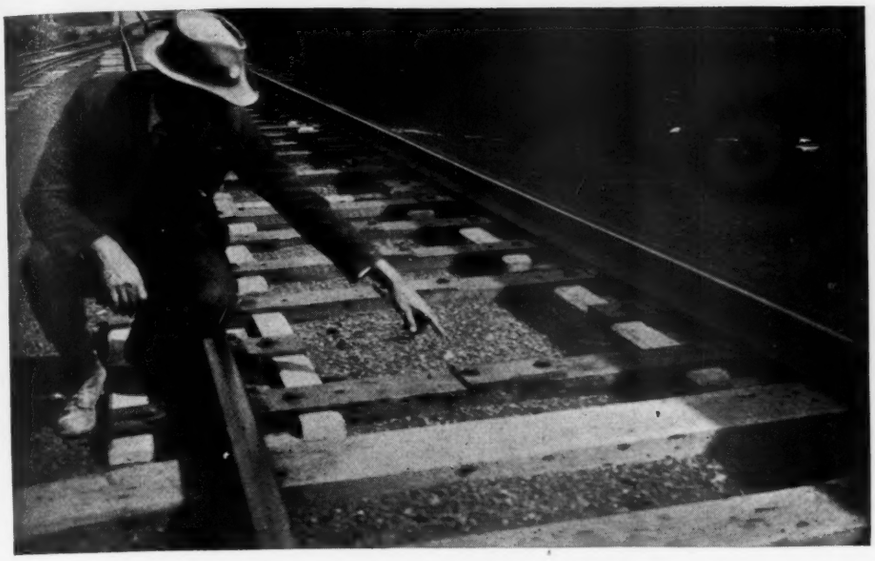
The more important properties of concrete units are discussed and some of the advantages of their use in masonry building construction are set forth. Concrete block, tile and brick have been defined and the recommendations for the standardization of sizes of the several types of units to avoid waste are given. The recommended standard sizes adopted are given as well as the large number of sizes in present use. This comparison shows that by maintaining definite standards of size for the units a large saving will result in the outlay for machinery, molds and pallets, as well as the stock to be carried in yards.

Various materials widely used in the manufacture of concrete products are described in detail. The questions of proper size and quality of both coarse and fine aggregates are discussed and the use of admixtures, facing materials and coloring processes are outlined. The need of careful proportioning, the proper time of mixing, the methods of molding and the several means of curing are discussed at some length. The requirements for concrete units are dealt with from the structural, architectural and fire resistant viewpoints. The methods for conducting tests of concrete products and the proper interpretation of data from test reports are outlined.

Factors affecting the financing of a concrete products plant are considered from an economic standpoint and suggestions are made to prospective investors to investigate fully all local conditions which may affect the life and successful operation of a plant.

The circular proper is followed by a bibliography of books, technical papers and periodicals dealing with various phases of the manufacture of these units which will be of particular interest to those contemplating entering this line of work. Several specifications are also given from the standards of the American Society for Testing Materials governing the quality of aggregates and the method of testing, together with the American Concrete Institute specifications for concrete block, tile and brick.

Those desiring copies of this paper should write, enclosing 20 cents, to the Superintendent of Documents, Government Printing Office, Washington, D. C., for Circular No. 304 of the Bureau of Standards.



Type of concrete tie invented by Harold A. Wills

Promising Form of Concrete Railroad Tie

ATTEMPTS to make a successful railroad tie of concrete have been without number. That which is illustrated here is the most successful form which has come to the notice of ROCK PRODUCTS, and it has been in service several months without showing signs of deterioration. Moreover it is made so that when the wearing part, which is a simple block of wood, does wear out, a repair can be made with very little work.

The ties shown in the picture are in the main line track, which passes through the plant of the Lawrence Portland Cement Co. at Siegfried, Penn., which is naturally interested in seeing a successful concrete tie developed. It was invented by Harold A. Wills, who has spent years of study on the concrete tie problem. Mr. Wills has proved to his own satisfaction at least that a solid, plain concrete tie, a solid reinforced concrete tie and a tie with steel connections will not work. By the side of this track is a large pile of broken ties which failed in service and helped to prove the statement just made. The form finally adopted consists of reinforced concrete bearing blocks connected by a wooden beam. This beam is in two pieces, joined by the fish plate, at which the man is pointing. When wood under the rail shows signs of wear it can be turned end for end. The holes are already bored to fit the bolts in the fish plate, the bolts by which the wood is fastened to the concrete block and for the spikes that hold the rail.

The concrete bearing block is cut away from the wood on both sides of the rail and sloped to drain off water so that the wood will dry out quickly after a rain. The wooden pieces are creosoted and thus there is full assurance against the rotting of the wood.

It has been found unnecessary to carry the wood across at every point where the rail is fastened. Hence the wide space shown in the picture between two ties. But the concrete bearing surface is made continuous under the three rail fastenings.

Mr. Wills figures the bearing surface with ordinary wood ties to be 12.672 sq. ft. per mile. With his concrete tie it is 15,417 ft. per mile. There is a great advantage in the fact that once the bearing surface is set it need never be disturbed in order to change the wooden piece, and hence the *effective* bearing surface is greater.

Mr. Wills figures a saving of 1056 tie plates and 2112 spikes per mile from the use of his tie from the fewer cross-pieces required. The wood is about 40% of that required to make an ordinary tie, as may be seen from comparing the two in the picture.

The concrete blocks are reinforced to prevent cracking and thus Mr. Wills is able to use as his slogan, "Concrete for permanence, steel for strength and wood for resiliency."

The ties shown here were installed in Oct., 1925, and since that time have been subject to a heavy freight traffic sometimes with a speed of 35 miles per hour. Ninety pound rails are used on this track. The ties had a severe test last winter, as ballast and subgrade were frozen solid. In the spring a few ties were taken out and carefully inspected and were found to be in perfect condition, so they were put back and were in use without change when a ROCK PRODUCTS editor saw them and made the photograph.

The success of this tie will add another to the long list of precast concrete units suitable for factory quantity production.

Marking Regulations Asked in Toronto

THE Toronto, Ont., city council, at its next meeting on Sept. 20, will be asked to adopt an amendment to its building laws, which calls for manufacturers' identification marks to be stamped on all brick, cement block or other similar building materials used in the city. If the council endorses this it will bar use in all future Toronto buildings of brick and cement block not so stamped.

Much Information on Concrete Masonry Construction

OF the many valuable pieces of printed matter which have been published by the Portland Cement Association none can be more highly commended than a recent bulletin under the title of "Concrete Masonry Construction."

The purpose of the bulletin is to give concise information on construction which employs concrete masonry units—block, brick and structural tile. This is for the benefit of architects, contractors and builders, and the physical make-up of the bulletin is such as to adapt it to the system of filing recommended by the American Institute of Architects and used in the offices of leading members of the profession.

The bulletin opens with a general discussion of the characteristics of concrete masonry, from the standpoints of load bearing, practicability of construction and esthetics. This is followed by a section of practical suggestions on building methods, the purpose of this section, and in fact the whole bulletin, being to connect up the special technique of concrete masonry construction with current methods of building.

To further carry out this idea there are included 20 pages of construction details, showing sizes and types of block and tile, methods of fitting floor construction to these units, chimney construction, wall sections showing how to install windows with concrete sills and lintels, roof construction for different types of cement shingles, and a variety of minor details which will be of great service in designing and building.

There are also included the standard specifications for block and tile of the American Concrete Institute, and a recommended building ordinance.

Concrete Floors for Residences

CONCRETE block above the grade will eventually be the type of construction, for the reason that people are beginning to learn that a fire resistive material is absolutely necessary to insure the greatest comfort. While it is true that the process of educating the people has been rather slow, still great progress is being made.

To further insure the home against the ravages of fire, a concrete floor should be built, especially the first floor. Since the concrete floor along with a concrete block wall practically makes a fire enclosure for the basement, should any fire result due to overheated furnaces it will not spread through the remainder of the house if a concrete floor has been constructed.

Therefore, in line with promoting a concrete block house, it is also well to promote a concrete floor, at least for the first story.—*Weekly Letter, Wisconsin Concrete Products Association.*

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	.....
Danbury, Conn.	1.50@2.00	2.00	1.75	1.50	1.35	1.25
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.25@1.35	1.20@1.30	1.10@1.20	1.05@1.10	1.05@1.10
Munns, N. Y.	1.00	1.35	1.35	1.25	1.25	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	.....
Watertown, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Afton, Mich.	.....	.....	.50	.....	.....	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Bloomville. Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.00	.....	1.10	.90	.95	.95
Carey, Ohio	1.05	1.05	1.05	1.05	1.05	1.05
Chasco, Ill.	1.00@1.30	.....	1.00@1.15	.....	1.00@1.15	.....
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	.....
			Flux 1.50@1.75			
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Greencastle, Ind.	1.25	1.25	1.15	1.05	1.05	.95
Milltown, Ind.	.....	90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
St. Vincent de Paul, Que.	.75	1.25	.90	.85	.80	1.00
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.50	2.00	2.00	1.85	1.85	1.85
Stone City, Iowa	.75	.....	†1.10	1.05	1.00	.....
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
SOUTHERN:						
Alderson, W. Va.	.50	1.50	1.40	1.30	1.20	.....
Brooksville, Fla.	.75	.....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.25	1.50	1.50	1.25	1.25	.....
Chico, Texas	1.00	1.35	1.30	1.25	1.15	1.10
El Paso, Tex.	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.50	1.60	1.50	1.35	1.25	.....
Graystone, Ala.			Crusher run, 1.00 per ton			
Kendrick and Santos, Fla.			3½ in. and less, 1.00 per ton			
New Braunfels, Tex.	.30@1.00	1.00@1.30	1.00@1.30	.70@1.00	.70@ .90	.....
Olive Hill, Ky.	.50@1.00‡	1.00	1.00	1.00	1.00	1.00
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	2.00	2.00	2.00	2.00	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.10	.....
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.40	1.40	1.40	1.40	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Tex.	2.50	2.25	1.55	1.35	1.25	1.25
New Haven, New Britain, Meriden & Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.50	2.00	1.80	1.40	1.40	.....
Oakland and El Cerito, Cal.	1.00	1.00	1.00	.90	.90	.....
San Diego, Calif.	.....	2.75	2.55	2.35	2.35	.....
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Springfield, N. J.	1.70	2.10	2.10	1.70	1.60	1.60
Toronto, Ont.	.....	3.53@4.00	.....	3.00@3.75	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.	.75	2.00	1.75	1.75	1.60	1.60
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.	.75	1.75b	1.75	1.40	1.40	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00@3.50	.....	2.00@2.50	2.00@2.25	.....	1.25@3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Pa. (sand-rock)	1.85@2.00a	.....	1.35@1.50	.....	1.00@1.50	.....
Toccoa, Ga.—Granite	.50	1.50	1.50	1.40	1.35	1.35

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40. (k) on cars, less 5c per ton discount.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	1.50
Cartersville, Ga.—Pulverized, 2.00; 50% thru 50 mesh	1.75
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Texas.—50% thru 50 mesh, bulk	1.50
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Joliet, Ill.—90% thru 100-mesh	4.24
Knoxville, Tenn.—80% thru 200 mesh, 80% thru 100 mesh, bags, 3.50; bulk	2.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; $MgCO_3$, 0.75%; 50% thru 100 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y.—Analysis, 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio, 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh, 2.10; 90% thru 50 mesh	1.65
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—50% thru 4 mesh	.50
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	3.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh 1.75
50% thru 4 mesh 1.50
Chasco, Ill.—50% thru 100 mesh 1.20
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh ..... .80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh 1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh 1.35
Danbury, Conn.—Analysis, 81 to 85% $CaCO_3$ ..... 3.75@ 4.75
Dundas, Ont.—Analysis, 53.8% $CaCO_3$; $MgCO_3$, 43.3%. 100% thru 10 mesh, 40% thru 50 mesh, 25% thru 100 mesh 1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh 1.50
Garnet, Okla.—All sizes 1.25
Kansas City, Mo.—50% thru 100 mesh ..... .75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh 2.00
Screenings (¼ in. to dust) 1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk 1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh .... 1.85@ 2.35
McCook, Ill.—90% thru 4 mesh ..... .90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh 1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh 1.50
Monroe, Mich. — Analysis, $CaCO_3$, 52.03%; 42.25% $MgCO_3$; 30% thru 100 mesh 2.30
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags 5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh 1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh 1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk ..... .80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes 1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk 3.00
Joliet, Ill.—85% thru 200 mesh 4.25
Piqua, Ohio, sacks, 4.50@5.00 bulk .... 3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh, bulk 3.00
Waukesha, Wis.—90% thru 100 mesh, bulk 4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W.Va.—Glass sand .. 2.25
Buffalo, N. Y. ..... 2.00@ 2.50
Cedarville and S. Vineland, N. J.—
Damp 1.75
Dry 2.25
Columbus, Ohio ..... 1.25@ 1.50
Estill Springs and Sewanee, Tenn. 1.50
Franklin, Penn. 2.00
Gray Summit and Klondike, Mo. ..... 1.75@ 2.00
Los Angeles, Calif.—Washed 5.00
Mapleton Depot, Penn. ..... 2.00@ 2.25
Massillon, Ohio 3.00
Mendota, Va. ..... 2.25@ 2.50
Mineral Ridge and Ohlton, Ohio 2.50
Oceanside, Calif. 3.00
Ottawa Ill. ..... .75@ 1.25
Pittsburgh, Penn. ..... 3.00@ 4.00
Ridgway, Penn. 2.50
Rockwood, Mich. ..... 2.75@ 3.25
Round Top, Md. 2.25
San Francisco, Calif. ..... 4.00@ 5.00
St. Louis, Mo. 2.00
Sewanee, Tenn. 1.50
Thayers, Penn. 2.50
Utica, Ill. ..... 1.00@ 1.25
Zanesville, Ohio 2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.50@ 1.75
Columbus, Ohio		.30@ 1.00
Dresden, Ohio		1.00
Eau Claire, Wis.	4.25	.60@ 1.00
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		75	.75		.75	
Montoursville, Penn.		1.00	.75	.75	.75	.75
Northern New Jersey	.40@ .50	.40@ .50	1.25	1.25	.90@1.25	
Olean, N. Y.		.75	.75		.75	
Portland, Me.	1.00	1.00	2.25		2.00	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Pa.		1.85			1.50	
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.60@ .85	.60@ .85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.60	.50	.40	.50	.60	.55
Barton, Wis.		.75		.75	.75	.85
Chicago, Ill.	.70	.60	.50	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Iowa		.40	1.50			
Eau Claire, Wisc.	.60@1.25	.45	.85@1.25	.95	.95	
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.50	.30	.40	.50	.50	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Haven, Mich.		.60@ .80		.60@1.00		.60@1.00
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.45	1.35
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.70	.70			1.60	
Palestine, Ill.	.75	.75	.75	.75	.75	.75
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	.93	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.90	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.			All sand, 1.40.	All gravel, 1.50.		
Chattanooga, Tenn.		1.65			1.45	
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.60@ .70				
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.00
Lindsay, Texas					.55	
Macon, Ga.	.50	.50				.80@ .90
New Martinsville, W. Va.	1.00	.90@1.00		1.30		
Roseland, La.	.50	.50	2.50	1.35	1.10	1.10
WESTERN:						
Kansas City, Mo.	1.00	.70				
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.00*	2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.65		1.35		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
East Hartford, Conn.			Sand, .75*			.65@1.00
Ferrysburg, Mich.						.55
Gainesville, Texas						.80
Grand Haven, Mich.						
Grand Rapids, Mich.				.60		
Hamilton, Ohio					.70	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Lindsay, Texas						.55
Macon, Ga.	.35	.35				
Mankato, Minn.			Pit run sand, .70			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ⅝ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.00	2.00	2.25			3.75	
Arenzville, Ill.	1.50@1.75			1.00			
Beach Sity, Ohio	1.75@2.00	1.75@2.00		1.75@2.25	1.75@2.50		
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.50@2.00	1.25@1.50	2.00@2.50	.30@1.50	1.50@2.00	2.75@3.50	1.50@3.00
Dresden, Ohio	1.40	1.50	1.50	1.25	1.50		
Eau Claire, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75	2.00	1.75			
Kasota, Minn.							1.10a
Klondike, Mo.	1.75		1.75	1.75	1.75		1.75
Mapleton Depot, Penn.	2.25	2.00		2.00	2.00	2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.20@ .30	.30		
Montoursville, P'n.				1.25@1.35			
Ohlton, Ohio	1.80	1.80	1.80	2.00	1.80	1.80	1.80
Ottawa, Ill.	2.50		2.50	1.25	.75	3.50	3.50
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.		1.25		1.60		2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.¶		.50@.85	.50@.90	.60@.75	.60@.90		
Utica, Ill.	.75	.65		.75	.75		
Utica, Penn.	1.75	1.75		2.00			
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) delivered.

Crushed Slag

City or shipping point	Roofing	¼ in. down	⅛ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium nd Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern, N. J.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	1.45*
Jackson, Ohio		1.05*		1.30*	1.05*	1.30*	1.30*
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	1.55*
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50z
Lime Ridge, Penn.					5.00a			
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Carey, Ohio	12.50	8.50	8.00		9.00		8.50	1.50
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio	15.00	8.50	8.50	9.00			7.50	1.50
Frederick, Md.		9.50	9.50	9.50	8.00	9.50	7.50	1.45e
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.50	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50						9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	.850	.850		9.00	11.00	9.00	1.50
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.	22.50						8.00	
Graystone, Ala.	12.50	10.00				1.45e	8.50	1.50
Keystone, Ala.		10.00	10.00	10.00	8.50	1.45u	8.50	1.50
Knoxville, Tenn.	20.25	10.00	10.00	10.00			8.50	1.50
Longview, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
Ocala, Fla.		13.00	10.00			1.60	12.00	1.70
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Calcite, Colo.							9.25	
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50
San Francisco, Calif.	21.00	19.00	16.50				14.00	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (1) to 10.00; (1) 80-lb. paper bags; (2) to 3.00; (3) to 9.00; (4) to 1.60. (8) to 16.00; (e) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Michigan City, Ind. (Engine sand)		.15@ .25
Mineral Ridge, Ohio	*1.75	*1.75
Montoursville, Penn.		1.25
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 3.00	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons, per gross	.08
	1.00@ 1.50
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	9.00@10.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags; 325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	9.00@14.50
Joliet, Ill.:	
Roofing talc, bags	10.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300 mesh), bags	13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 75%	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.25@ 8.25

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%	8.00
Twomey, Tenn.—B.P.L. 65%	8.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75
72% min. B.P.L., Basis 72%	4.25
75/74% B.P.L., Basis 75%	5.25
77/76% B.P.L., Basis 77%	6.25

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H. — per ton, mine run	360.00
Mine scrap	22.00
Clean shop scrap	25.00
Roofing mica	35.00
Dry ground, 20 mesh	35.00
40 mesh	40.00
60 mesh	45.00
200 mesh	65.00
Punch mica, per lb.	.10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	.....	10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	.....	†6.00
Buckingham, Que.—Buff stucco dash	.....	‡12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries	.....	17.50
Crown Point, N. Y.—Mica Spar	.....	8.00@10.00
Easton, Penn., and Phillipsburg, N. J.	10.00@16.00	10.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash	.....	6.00@18.00
Middlebrook, Mo.—Red	.....	20.00@25.00
Middlebury, Vt.—Middlebury white	.....	*9.00
Marble flour, 100% thru 80 mesh	.....	3.50
Crusher run marble	.....	3.50
Milwaukee, Wis.	.....	14.00@34.00
Newark, N. J.—Roofing granules	.....	7.50
New York, N. Y.—Red and yellow Verona	.....	32.00
Red Granite, Wis.	.....	7.50
Stockton, Calif. — "Natrock" roofing grits	.....	15.00@20.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	12.00
Warren, N. H.—cement facing (mica), per ton	.....	7.50
Wauwatosa, Wis.	.....	20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk	6.75@ 7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 95% thru 200 mesh, bags included, carloads	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 98% thru 200 mesh, bags	21.00
Bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 65% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Pa.—Color, white to light cream; 98% thru 150 mesh, bags, 11.00@13.00; bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk	16.00

(Bags 11 cents each, non-returnable)

Blended Feldspar
(Pulverized)

Tenn. Mills—Bulk	16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	12.00‡
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone)	7.00@ 9.00
Knoxville, Tenn. (limestone), bags, per ton 7.00; bulk	5.00
Los Angeles Harbor (limestone), 100-lb sack, 1.00; sacks, per ton, 8.50@ 9.50†; bulk, per ton	6.00@7.00†
Toughkenamon, Pa.—(Feldspar) 100-lb. bags, 1.00; bulk, per ton	10.00
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren, N. H.—(Mica) per ton	7.70@7.90‡
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.00*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.50@13.50
Detroit, Mich.	15.00
Farmington, Conn.	17.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	12.25
Lancaster, N. Y.	12.50
Madison, Wis.	a12.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.00
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	19.75
Saginaw, Mich.	13.00
San Antonio, Texas	15.00
Sebewaing, Mich.	12.00
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	13.00@15.60†
Toronto, Canada	13.10
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Delivered in city limits.
‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O. M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.....	3.37
Atlanta, Ga.	.....	2.35
Baltimore, Md.	.....	2.15
Birmingham, Ala.	.....	2.30
Boston, Mass.	.....	2.53
Buffalo, N. Y.	.....	2.28
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	.....	2.34‡
Charleston, S. C.	.....	2.35
Cheyenne, Wyo.	.82¾	3.3:
Cincinnati, Ohio	56¾	2.37‡
Cleveland, Ohio	.....	2.29‡
Chicago, Ill.	.....	2.10‡
Columbus, Ohio	.....	2.24
Dallas, Texas	.....	2.10
Davenport, Iowa	.....	2.29‡
Dayton, Ohio	.57	2.28
Denver, Colo.	.66¼	2.65
Detroit, Mich.	.....	2.15‡
Duluth, Minn.	.....	2.09‡
Houston, Texas	.....	2.60
Indianapolis, Ind.	.....	2.19
Jackson, Miss.	.....	2.50
Jacksonville, Fla.	.....	2.20
Jersey City, N. J.	.....	2.23
Kansas City, Mo.	.....	1.92
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.54¼	.....
Memphis, Tenn.	.....	2.60‡
Milwaukee, Wis.	.....	2.25‡
Minneapolis, Minn.	.....	2.32‡
Montreal, Que.	.....	1.36
New Orleans, La.	.....	2.20
New York, N. Y.	.....	2.15
Norfolk, Va.	.....	2.07
Oklahoma City, Okla.	.....	2.46‡
Omaha, Neb.	.....	2.36‡
Peoria, Ill.	.....	2.27‡
Philadelphia, Penn.	.....	2.31
Phoenix, Ariz.	.....	2.91
Pittsburgh, Penn.	.....	2.09‡
Portland, Colo.	.....	2.80
Portland, Ore.	.....	2.80
Reno, Nevada	.75¼	3.01
Richmond, Va.	.....	2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.	.....	2.31‡
Savannah, Ga.	.....	2.50
St. Louis, Mo.	.55	2.20‡
St. Paul, Minn.	.....	2.32‡
Seattle, Wash.	10c discount	2.65
Tampa, Fla.	.....	2.25
Toledo, Ohio	.....	2.20‡
Topeka, Kans.	.....	2.41‡
Tulsa, Okla.	.....	2.33‡
Wheeling, W. Va.	.....	2.07
Winston-Salem, N. C.	.....	2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents less to dealers.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	.....	1.85
Chattanooga, Tenn.	.....	2.45*
Concrete, Wash.	.....	2.35
Davenport, Calif.	.....	2.05
Detroit, Mich.	.....	2.15
Hannibal, Mo.	.....	2.05
Hudson, N. Y.	.....	2.05
Leeds, Ala.	.....	1.95
Mildred, Kans.	.....	2.35
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.95
Richard City, Tenn.	.....	2.05
Steelton, Minn.	.....	1.90
Toledo, Ohio	.....	2.20
Universal, Penn.	.....	1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Detroit, Mich.‡	.....	.....	.....	11.30	11.30	11.30	.....	8.00	.....	.....	.....	.....	.....
Delawanna, N. J.	.....	.....	.....	.....	.....	8.00	.....	8.25@9.40	.....	.....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	.....	.....	7.00	.....	.....	15.50d	18.50	.....	30.00	15.50	.....	.....	.....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	.....	24.55	20.00	.....	.....	.....
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	19.00	7.00	27.00	19.00	.....	15.00	30.00
Los Angeles, Calif.	.....	.....	.....	8.65r	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Cal.	.....	.....	.....	14.00	14.40	15.40	.....	15.40	.....	.....	.....	.....	.....
Seattle, Wash.	6.50	.....	11.00	16.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sigurd, Utah	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	21.50	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (f) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	.....	.....
Columbus, Ohio	.16@.18a	.....	.....
Detroit, Mich.	.16	.....	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15	.....	.....
Graettinger, Iowa	.18@.20	.....	.....
Indianapolis, Ind.	.14@.16†	.....	.....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a	.....	.....
Olivia and Mankato, Minn.	9.50b	.....	.....
Somerset, Penn.	.20@.25	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate Red and Orange	Yellow, Tan Green and Blue	Slate Gray
French and Spanish†	$11.50	$13.50	$12.75
Ridges (each)	.25	.35	.30
Hips	.25	.35	.30
Hip starters	.50	.60	.60
Hip terminals, 2-way	1.25	1.50	1.50
Hip terminals, 4-way	4.00	5.00	5.00
Mansard terminals	2.50	3.00	3.00
Gable finials	1.25	1.50	1.50
Gable starters	.25	.35	.30
Gable finishers	.25	.35	.30
*End bands	.25	.35	.30
*Eave closers	.06	.08	.06
*Ridge closers	.05	.06	.05

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.	18.00
Indianapolis, Ind.—9"x15"	
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash. (Stone-Tile)	Per 1000
3½x6x12	60.00
3½x8x12	65.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 1000
5x8x12	70.00
Houston, Texas:	
5x4x12 (Lightweight)	45.00
5x8x12 (Lightweight)	80.00
Pasadena, Calif.—(Stone Tile	Per 100
3½x4x12	3.00
3½x6x12	5.00
3½x8x12	6.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile)	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.	14.00 22.50@27.00
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa drain tile per 100 ft.	
5-in.	4.50
6-in.	5.60
8-in.	9.00
10-in.	12.00
12-in.	17.50
14-in.	25.00
16-in.	35.00
18-in.	45.00
20-in.	60.00
22-in.	70.00
24-in.	80.00
30-in.	100.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	9.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	
Milwaukee, Wis.	14.00@15.00	30.00@75.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	12.50	
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	22.50
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	21.00@42.00
Westmoreland Wharves, Penn.	15.00	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

†Gray. ‡Red.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	.....	.40	.50	.60	.70	.....	.....	.....	.....	.....	.....	.....
G'd Rapids, Mich. (b)	.....	.....	.....	.60	.72	1.00	1.28	.....	.....	1.92	2.32	3.00	4.00	5.00	6.00	.....	.....
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	†1.70	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	...	...	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.							6 in. to 24 in., $18.00 per ton										
Olivia & Mankato, Minn.												12.00 per ton					
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tiskilwa, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	.....	3.40	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	...	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.							12 in. to 60 in. 18.00 per ton										
Yakima, Wash.							$10.00 per ton										

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

Northwest Products Men Plan Next Convention in Seattle

THE Northwest Concrete Products Association closed their recent meeting at Pacific City, Wash., with the adoption of several interesting resolutions. Among these was one urging the next session of the Washington legislature to place the Washington local improvement bonds on par with similar securities of other states. The next meeting will be held in Seattle the latter part of January.

The association also voted to join the National Concrete Pipe Association with the aim of co-operating in harmony with the national organization for the betterment of the Northwest association.

Another resolution recommended the establishment of scholarships in the state universities of Washington, Idaho and Oregon, the one at Washington University to be assured at once, and at the other two universities later. The Northwest Concrete Pipe Association would work with the officials of the universities in executing plans for the scholarships. The awards would be made to students who furnish the most creditable theses on the concrete industry.

The resolutions also recommended thanking C. H. Bullen, formerly of Portland, but now of Chicago, for his efforts in behalf of the Northwest association. Dues of the associate members of the association were fixed at $15 annually.

New Type of Cement Block

A RECENT announcement in the Tampa (Fla.) *Tribune* states that basic patents have been obtained on a process of making cement blocks with tongue and groove. The ultimate purpose of the system is to produce a material for house construction which will greatly reduce building costs. A new company has been organized by R. T. Bell at Arcadia, Fla., to manufacture this type of block.

Mr. Bell, speaking at a weekly luncheon of the Arcadia Lions Club, said the company hoped soon to be able to construct a complete house from the blocks, as a demonstration of their possibilities. He said a machine for making the blocks on a quantity basis had also been designed by Mario Cutayar, inventor of the block, and the company would built one of these machines.

Cost of Hydraulic Sluicing

SLUICING a bank with a stream of water from a pump is a method that looks so simple and easy that those who have not investigated it think it must be inexpensive. On the contrary, it is often one of the most expensive methods of excavating. Where the ground is hard and the pumps have to supply a high pressure stream in addition to pumping through a long line, the costs may run up to a surprising figure.

In the work in the Miami Conservancy District over 2,000,000 yards of material were removed by sluicing. Accurate records of costs were kept and costs included all overhead and depreciation charges, in fact everything that could properly be charged to the work. Some of these follow, taken from *Engineering and Contracting:*

Cost of Sluicing at Taylorsville During the Early Period of Work

Quantity moved—243,500 cu. yd.

		Unit Cost per cu. yd.	Pct. of Total
Superintendence and overhead	$ 9,475.03	$0.039	6.1
Labor	28,086.09	0.113	17.4
Supplies	89,469.00	0.368	56.8
Electric power	10,324.68	0.042	6.5
Plant depreciation	20,722.53	0.086	13.2
	$158,077.33	$0.648	

Cost of Similar Work After Installation of High Pressure Equipment

Quantity moved—164,800 cu. yd.

		Unit Cost per cu. yd.	Pct. of Total
Superintendence and overhead	$ 3,620.77	$0.022	6.2
Labor	23,343.36	0.143	40.2
Electric power	9,802.31	0.060	16.8
Supplies	13,680.83	0.084	23.6
Plant depreciation	8,195.00	0.047	13.2
	$58,642.27	$0.356	

Labor was being paid 38c to 46c per hour, blacksmiths 60c per hour, monitor men 55c to 60c per hour, pump runners 50c to 55c per hour, all men on an hourly rate being given 11 hours' pay for 10 hours' work (time and a half after eight hours).

The ground sluiced was hard blue clay that required blasting, and the cost of explosives are included in "supplies."

At the Lockington dam borrow pit the ground is described as a deposit of sand and gravel on one side and a bank mostly of blue clay on the other. The clay did not require blasting. On this easier ground the costs were:

Cost of Sluicing at Lockington for Four Months Period

Quantity moved—280,600 cu. yd.

		Unit Cost per cu. yd.	Pct. of Total
Superintendence and overhead	$ 3,500.00	$0.012	5.8
Labor	27,306.10	0.097	46.6
Power	16,353.72	0.058	27.9
Supplies	5,596.19	0.020	9.6
Plant depreciation	5,981.53	0.021	10.1
	$58,737.54	$0.208	

The report states that:

"The above figures might be taken as representative for the approximate cost of a straight sluicing job in gravel, where there is a free getaway for the material and no probabilities of delays because of other dependent features of the job."

Another set of cost figures which included transporting the sluiced material through a pipeline is as follows:

	Unit Cost	Pct. of Total
Superintendence and overhead	$0.018	3.7
Labor	0.142	28.5
Electric power	0.208	41.7
Supplies	0.019	3.8
Plant depreciation	0.111	22.3
	Per cu. yd., $0.498	

It is stated that the cost of sluicing alone without pipeline maintenance on this job did not exceed 44c.

The above costs were obtained under somewhat difficult conditions and the author of the report doubts that the excavation by other methods would have been much cheaper. There is no intention here to criticize either the figures or the determination to use sluicing in preference to other methods. The intention is to point out that even where the best of machinery and engineering skill is available, as it was in the Miami Conservancy operation, the cost of moving material by sluicing may run to large figures.

Glass Sand of Winnipeg District Compared with Ottawa Sand

SAND for the manufacture of glass is available, it is reported through the Industrial Development Board of Manitoba, on Black Island, Park Island, Lake Winnipeg. The sand on Black Island, it is said, is of high grade of purity, with not too much iron for most types of glass, and by washing it can be graded up to meet the glass-sand requirements. It is rounded sand of the following size in comparison to the Illinois (Ottawa) sand:

	Black Island Sand	Ottawa Sand
Through 20 mesh	97.2%	98.8%
Through 40 mesh	84.3	82.6
Through 60 mesh	57.7	56.2
Through 80 mesh	27.8	17.2
Through 100 mesh	14.6	9.0
Through 150 mesh	4.6	4.1

The following average analyses are given for comparison:

	Black Island Sand (partial analysis)	Ottawa Sand (Illinois)
SiO_2	97.70%	99.48%
Fe_2O_3	.31	.02
Al_2O_3	1.13	.16
CaO	.16	.11
MgO	.....	.05
Loss on ignition	.....	.13

The Ottawa sand has been doubly washed; the Black Island sand is unwashed. By washing the greater part of the alumina and some of the iron can be removed. The similarity in the rounding of the grains of these two sands is striking, and quite different from the other sands in this area. The other sands in the province which are of glass and grade are the Dakota sandstone and the Beausejour sand.—*Ceramic Industry.*

Fire Damages No. 2 Plant of Neal Gravel Company

THE No. 2 plant of the Neal Gravel Co. at Attica, Ind., was badly damaged by fire July 24, the loss amounting to $30,000, according to local newspaper reports. It is expected that the plant will be rebuilt and A. W. Harris, the manager, stated that he hoped it would be in production in 60 days.

This is one of two plants the Neal company operates at Attica. It also operates plants at Cayuga, Covington, Summit Grove and Wolcottville, Ind., and a plant at Palestine, Ill. The company is one of the largest producers in the Wabash valley. Its main office is at Mattoon, Ill.

Bangor Slate Association Resumes Activities

THE slate manufacturers of Bangor, Penn., have reorganized the Bangor Slate Association and reopened offices at Bangor. The association will continue as before in bringing about greater co-operation between slate producers and architects, roofers, contractors, etc., by distributing among them the results of association research on slate. All shipments of Bangor slate will be inspected and labeled by the association and a certificate guaranteeing its genuineness issued to the users. A publicity campaign to foster the appreciation and use of Pennsylvania slate for roofing has been started.

The Bangor association is composed of slate quarrymen operating in the Bangor district. The officers are: William Blake, president; A. M. Jones, vice-president; William S. Ditchett, treasurer, and H. M. Van Cleve, secretary.

Production of Phosphate Rock in 1925

THE total quantity and value of phosphate rock mined in the United States and sold in 1925 were 3,481,819 long tons, valued at $11,545,678, according to a statement made by the Bureau of Mines, Department of Commerce, which was compiled from individual reports furnished by producers. The figures indicate an increase of 21% in quantity and of 13% in value as compared with 1924.

The following table shows the quantity and value, by states, of the various kinds of phosphate rock mined in the United States and sold in 1925:

State—	Long tons	Value
Florida:		
Hard rock	378,692	$1,448,526
Land pebble	2,551,272	7,340,544
Idaho:		
Western rock	65,934	289,498
South Carolina:		
Land rock	2,147	8,051
Tennessee and Kentucky:		
Blue and brown rock	477,077	2,429,059
Wyoming:		
Western rock	6,697	30,000

Imports of phosphate rock in 1925, which were 2,735 long tons, valued at $37,932, indicated a decrease of 83% in quantity, and of 79% in value. Exports amounted to 922,655 long tons, valued at $6,559,360, an increase of 13% in quantity and 28% in value.

New Machinery and Equipment

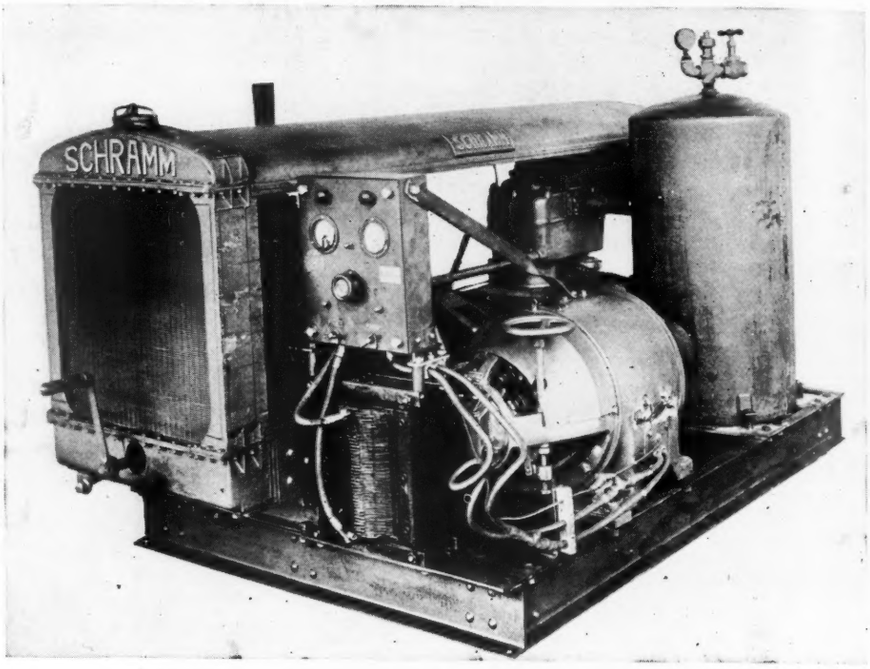
Combination Welder and Air Compressor

A COMBINATION air compressor and arc welder driven by a gas engine and mounted on a single base has been placed on the market by Schramm, Inc., of West Chester, Penn. The outfit consists of a Buda gasoline engine, a Schramm compressor and a General Electric welding outfit. The complete equipment may be mounted on a standard two-ton truck or can be made portable by adding steel or rubber-tired wheels.

The Buda engine is a 24-hp., 800-r.p.m. unit which may be started and operated independently of either the compressor or welding generator. The Schramm compressor is a two-cylinder, water-cooled machine with a capacity of 120 cu. ft. per min. and equipped with an automatic unloading device. The air receiver is 16 in. in diameter by 42 in. high. The General Electric welding equipment consists of a belt-driven WD-12 arm welder with an idler pulley for belt tightening. By the use of a Borg & Beck 12-in. clutch coupling, either of the machines may be connected to the engine.

This combination outfit is expected to be quite useful in field work. The air compressor can be used to operate drills, grinders and chipping hammers for cutting, peening, caulking, cleaning off scale and preparing work for welding. The welder, it is said, can be used both for welding light and heavy gauge steel as well as cast iron. After the welding is completed the compressor clutch is thrown and the weld can be ground or chipped as desired. Thus a complete job can be done with the single machine.

The structural steel base is 8 ft. 4 in. long, 5 ft. 11 in. wide. The outfit is 3 ft. 10 in. high. The total net weight of the outfit is 4000 lb.



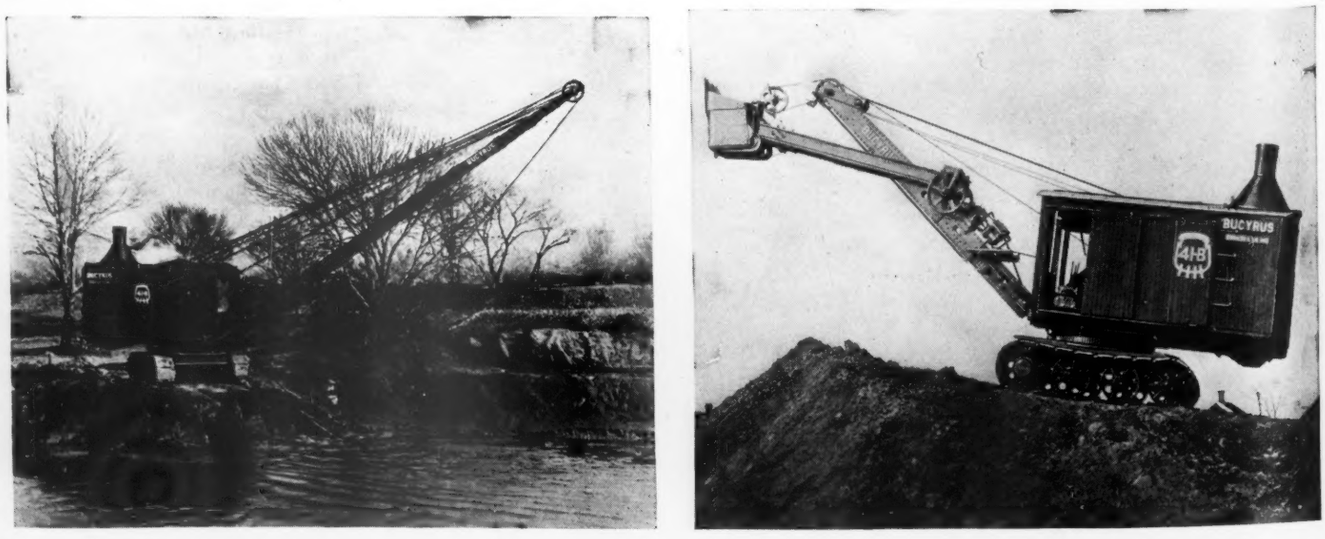
Portable combination electric welder and air compressor

New 1¼ Yard Shovel

THE 41-B, a 1¼-yd. shovel, has recently been announced by the Bucyrus Co., South Milwaukee. This shovel has been built primarily for excavation where a larger dipper than 1-yd. is desirable.

The shovel, which has a two-part hoist, is convertible to a dragline and is so designed that the drum speed is the same for dragline or shovel work. To convert the shovel to a dragline it is necessary only to add the drag drum, change the booms and cables and add the fairlead. The drag drum is mounted well back on the shovel, giving the desirable long lead from the fairlead to the drum.

As a dragline the machine is offered with a 40-ft. boom and a 1-yd. bucket or a 45-ft. boom with a ¾-yd. bucket.



New 1 1-4 yd. shovel. At the right as it appears in ordinary use and at left converted to a dragline

Except for the larger capacities and working ranges, making correspondingly heavier working parts, the Bucyrus 41-B is a companion machine to the Bucyrus 31-B, the 1-yd. shovel recently announced by this company.

Details for the machine are box girder boom, outside dipper handles, two-part hoist working over a larger diameter sheave, cast base and revolving frame and caterpillars employing larger diameter roller and tumblers. It takes its place midway between the 31-B 1-yd. shovel and the 50-B, a 1¾-yd. shovel.

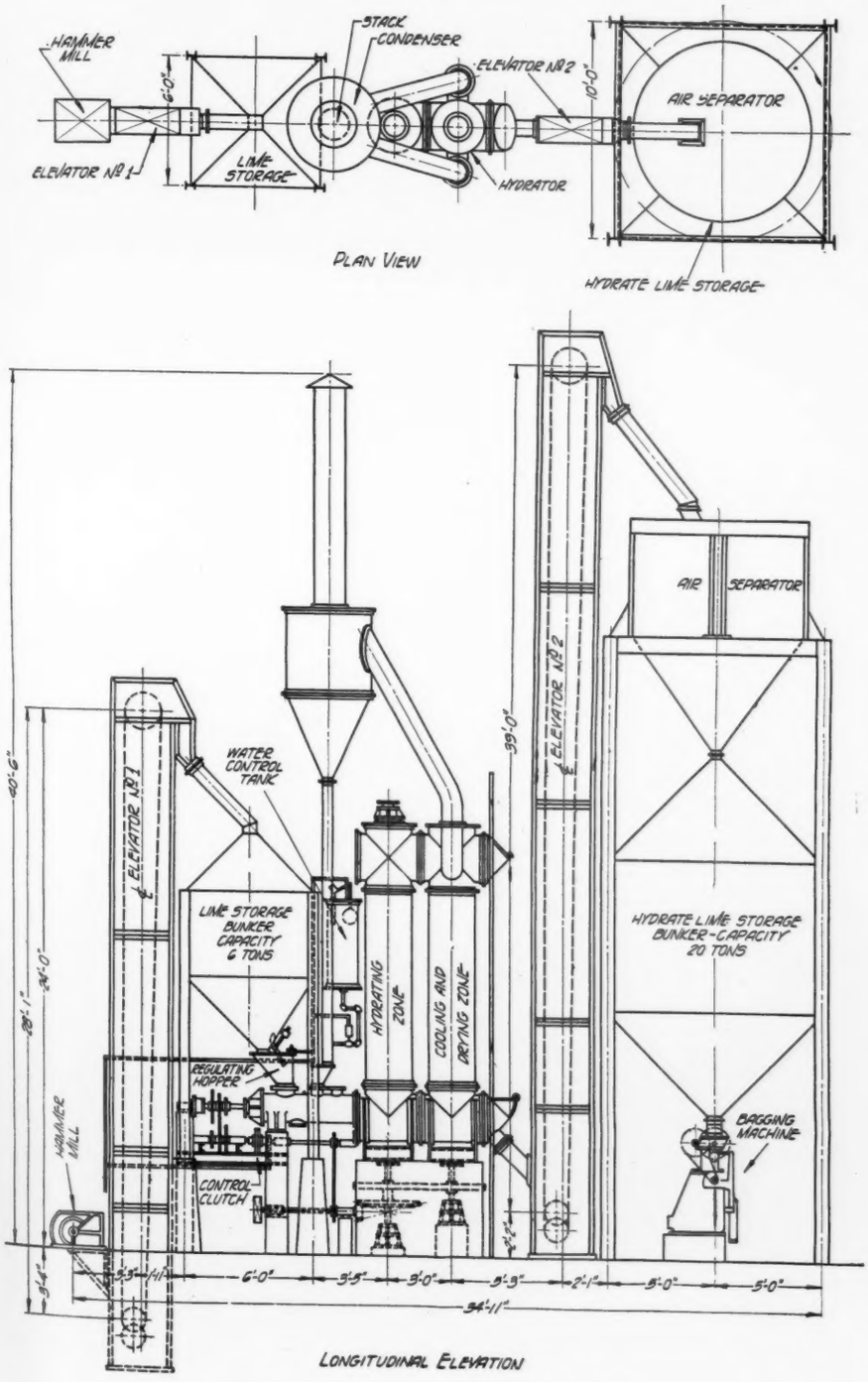
Small Hydrating Plant

THE accompanying sketch shows the latest arrangement for a small hydrating plant designed by the Schaffer Engineering Co., Pittsburgh, Penn. The plant is said to have a minimum capacity of 4 tons per hour and to produce a good grade of hydrated lime. Only 40 hp. is required to drive the entire hydrate plant.

The plant is equipped with the Schaffer Superhydrator No. 3, which is a specially designed small unit. With this machine, it is said, there is required no accessory equipment such as floors, tanks, weigh hoppers, etc., requiring only a concrete foundation. The machine operates automatically, the quicklime being fed from the storage mounted so that it is spouted directly into the feeder mechanism of the hydrator. An automatic hopper is used where the material is fed from an elevator.

Co-ordinating with the automatic feed is a water supply regulator which automatically shuts off the water feed in case the quicklime fails while the lower section of the automatic hopper is made to shut off the water supply in case the quicklime supply fails. The quicklime and water are discharged into a screw conveyor, giving them an intimate mix before they enter the hydrator proper, which consists of two vertical cylinders. In the first cylinder is where hydration takes place, and the second is the drying or cooling compartment. An outlet stack is provided at the top of this cylinder which takes excess moisture and drying air up into the condensing chamber, where particles of lime carried in suspension are precipitated and carried back into the screw feeder feeding the hydrator. From the drying section the lime passes on to a screw conveyor which delivers it to air separation mills, elevator or other conveyance to storage.

The Schaffer company puts a price of $9,000 f.o.b. Pittsburgh on the entire hydrate plant equipped with No. 3 hydrator, hammer-mill, two elevators and an air separating mill. The hydrator itself is priced at $4,700 f.o.b. Pittsburgh.



General plan of small hydrating plant

Molded Brake and Friction Blocks

AN asbestos friction material, molded into the desired shape or size to fit any friction clutch, etc., on machinery such as hoists, shovels, draglines, etc., is announced by the Thomas L. Gatke Co., Chicago, Ill. It is claimed by the manufacturers that through the use of "Asbesgraphite," brake adjustments to meet change of temperature of the frictions are eliminated and the housings are kept in smooth condition at all times. It is said that the material is self-lubricating, non-scoring, a non-absorbent of oil or water, and unaffected by temperature changes. The "Asbesgraphite" is furnished by the manufacturers as desired by the user and either molded in a solid piece or in sections.

Brake block (above) and cone type friction (below) made of molded asbestos material

News of All the Industry

Incorporations

Grand River Gravel Co., Ltd., Toronto, $40,000. To mine and deal in sand and gravel.

Macon Crushed Granite Co., Wilmington, Del., $165,000. (Corp. Trust Co. of America.)

Rusling Stone Co., Newark, N. J., $125,000. I. R. Heller, N. Strijesky and T. M. Kugel.

Texas Quarry Co., McAllester, Okla., $100,000. (U. S. Corp. Co.)

American Slate Co., Caddo Gap, Ark., $30,000. R. B. Buckley and G. S. Harvey.

Whitely Concrete Co., Fort Worth, Tex. W. P. Camp, Jr., and B. J. Whitely.

Concrete Roofing Tile Co., Chattanooga, Tenn. E. M. Broady, G. E. Rolland.

Stone-Tile Co., Portland, Ore., $30,000. R. L. Tucker, R. B. Greenwood and V. A. Johnson.

Southern Stone Tile Co., Jackson, Miss., $15,000. Charlie Scott, J. M. Evans, 322 Alexander Ave., Jackson.

Rio Grande Cement Plaster Co., San Antonio, Tex., 500,000 shares of no par value. Lee Dekle, J. L. Brown, Gibbs Bldg., San Antonio.

Metropolitan Concrete Co., New York, N. Y., $10,000. R. A. Parella and others. (Filed by Diserio Bros., 31 Chambers St., New York.)

Pioneer Crushed Stone Co., Joliet, Ill., $15,000. C. L. Hermes, J. H. Sharp and F. A. Prehn. Office: 708 W. McDonough St., Joliet.

Union Sand and Gravel Co., Charleston, Ohio, $25,000. J. F. Fratzker, G. B. Shade, G. C. Champagne and others.

Cleveland Sand and Gravel Co., Cleveland, Ohio, $10,000. N. J. Dobkins, D. D. Santo, N. B. Carmosino and others.

Atlas Kentucky Rock Co., Wilmington, Del., $1,000,000. To mine and deal in rock asphalt. (Corp. Service Co.)

Central Mixed Concrete Co., Portland, Ore., $10,000. H. M. Johnson, C. W. Myers and C. D. Malcolm.

Tennessee Crushed Rock Co., Knoxville, Ill. C. C. Benner, H. M. Rhinehart and Charles McMillan. Corr.: C. C. Benner, Knoxville, Ill.

New Orleans Gravel Co., Inc., New Orleans, La., $15,000. W. A. Bisso, 123 Walnut Street, and others.

Interlocking Tile Corp., Seattle, Wash., $25,000. Albert Armstrong, F. A. Huffer and W. H. Hayden.

Fairmont Limestone and Sand Co., Charleston, W. Va., $30,000. E. N. Eddy, G. R. Morgan, W. A. Lawler, all of Fairmont, W. Va.

Evans Concrete Co., Inc., Philadelphia, Penn., $25,000. (Corporation Guarantee and Trust Co., Philadelphia.)

Longford Crushed Stone, Ltd., Orillia, Ont., $40,000. Allan McPherson and others of Orillia and Morton Craig. To quarry and manufacture stone.

Northwestern Limestone Co., Wilson, Wisc., $50,000. E. H. and C. Shultz and E. C. Quilling. To quarry and crush stone and manufacture lime products.

Duntile Products, Ltd., Hamilton, Ont., $200,000. William Carter, W. R. Carter, William Theaker and others. To manufacture and deal in cement, brick, tile, lime, artificial stone, etc.

Blue Lake Sand and Gravel, Ltd., Toronto, $50,000. James Franceschini, Leonard Franceschini, Charles Johnston and others. To open and manage gravel pits, handle stone, etc.

Mound Street Gravel Co., Columbus, Ohio, 2,000 shares of $100 par and 4,000 shares of common no par. H. R. Gill, C. P. McClelland, C. O. Rhoads, G. E. Murphy.

Richmond Sand and Gravel Corp., Richmond, N. Y., 300 shares common, no par. P. Feiner, A. G. Scheer, M. Hicks. (Corr.: Stern & Reubens, 149 Broadway, New York.)

Border Sand Brick Mfg. Co., Ltd., Windsor, Ont., 1,750 shares preferred stock of $100 par value, 1,750 shares common of no par value. J. T. Jacquet, Joseph Gormond and others of Montreal and Joseph Henry of Windsor. To manufacture and deal in brick and tile.

Quarries

West Virginia Pulp and Paper Co. have purchased a limestone deposit near Greenwich, N. Y., and will start quarrying operations within a short time. The company expects to produce agricultural limestone and crushed stone in addition to making lime for its own use at the paper mills. The deposit is located in what was once one of the greatest lime manufacturing districts in the country.

Sinclair Quarry and Construction Co. have moved their offices to the plant and quarries at Vigus, Mo. The quarry property was recently purchased by the Hanick brothers and the new officers of the company are F. H. Hanick, president; O. J. Hanick, vice-president, and M. J. Hanick, secretary and treasurer. C. H. Slaughter was formerly president.

Evansville Sand and Gravel Co., Evansville, Ind., have opened another quarry at Golconda, Ill., to rush the completion of the order for 40,000 cu. yd. of stone contracted for by the U. S. government which is to be used on construction work at Dam 52.

Frenchtown, Mich. The old crushing plant of Thornton Dixon located at Frenchtown was damaged through recent fire with an estimated loss of about $8,000. The plant, a frame structure, was built 20 years ago at a cost of $35,000, but has not been in operation since 1914.

Red River Crushed Stone Co., Heber Springs, Ark., has been running at full capacity since it began operation on June 15. The daily output is about 15 cars of stone.

Alabama Marble Co., Birmingham, Ala., are reported to have taken option on a large deposit of marble land near Sylacauga, Ala.

Hutchinson & Co., Oakland, Cal., have leased the University of Stanford quarries at Palo Alto and will construct a spur track from the Southern Pacific railroad.

Col. John D. Taylor is soon to begin the development of a marble quarry near Summerville, Tenn.

Sand and Gravel

William Grayson, Jr., has purchased 97 acres of gravel land at Delight, Ark., from W. O. Whitehorn for a consideration of $5,500. It is planned to organize a company to be known as the Wolf Creek Sand and Gravel Co. and to erect a 10 car per day plant on the location, to be connected with the main line, which is about 500 ft. from the proposed plant site.

Erie County, N. Y. The county board of supervisors have voted an appropriation of $100,000 to purchase the sand and gravel deposits on the Meyer and Meyer farm in East Lancaster, N. Y. The property consists of 88 acres of land, buildings and machinery.

Ross Island Sand and Gravel Co. has let the contract for the erection of a new plant on Hardtack Island, Ore., to the Baker Construction Co., Portland, Ore. The estimated cost is about $30,000.

Norfolk Sand and Gravel Co., Norfolk, Va., has applied for a permit to construct a 600 ft. dock on the waterfront of the James River at City Point Station, Hopewell, Va.

James Diles Co. sand and gravel plant at River Valley, Penn., was damaged recently by a fire of unknown origin. The large crusher house and office building were totally destroyed, according to the report. These structures were located at a distance from the road and inaccessible to fire apparatus.

Advance Industrial Supply Co., Washington, Mo., is building an addition to their Pacific plant and installing new machinery which is expected to increase the plant capacity from 8 to 20 tons per day. The company manufactures roofing grit from Meramec gravel, shipping to many parts of the country.

McHenry County, Ill., has leased a gravel pit near Wauconda, Ill., from Edward Belshi. The county will pay 12½ cents per yard for all gravel removed. The estimated cost of the crushed gravel delivered to the project will be about 50 cents per yard, it is said.

S. J. Taylor, for 20 years president of Pinkston Sand Co., has purchased half a mile of Lake Michigan frontage in Michigan City, Ind., with hills estimated to contain 100,000 carloads of clean drift sand. He expects to open a sandpit in October on this land and will operate as the S. J. Taylor Sand Co.

Shelton Sand and Gravel Co., Shelton, Wash., have completed enlarging their plant and are now operating 16 hours a day to turn out material for a large contract. The company is delivering about 100 yd. of washed and screened gravel per day. William Gaul, the owner of the company, also operates a central concrete mixing plant in conjunction with the sand and gravel operations.

Valley Rock Products Co. has opened offices at San Fernando, Calif., in charge of S. A. Thompson.

Springfield Sand and Gravel Co., Springfield, Ore., is about ready to operate its new plant just south of the old one now in operation. H. W. Chase states that his company is installing new buckets and hoist, which with the new bins will accommodate orders for any size gravel required.

Gypsum

Iona Gypsum Products of Iona, Cape Breton, Nova Scotia, is the successor of the Iona Gypsum Co., which ceased operation in March, 1922. The company is capitalized at $250,000, divided into $100,000 preferred and $150,000 common, fully paid up. There is also $50,000 in bonds and $50,000 in debentures. The main office is at Sydney, N. S. The officers and directors are: H. C. Ballem, president; A. A. McIntyre, vice-president; B. B. McNeil, secretary-treasurer; directors: F. A. D. Young, H. M. Israel, I. W. Buckley, J. D. McCormick and P. D. Parks.

U. S. Gypsum Co., Chicago, Ill., is carrying on investigations on the gypsum deposits at Decewville, near Cayuga, Ont., to ascertain their commercial possibilities. The work of shaft sinkings, test boring, etc., is in charge of Francis Payne.

Standard Gypsum Co., Long Beach, Calif., has recently completed a storage addition for housing paper sacks. The building is a 1-story structure with concrete foundation and walls and roof of galvanized siding.

Manitoba Gypsum Co. have started test work on the gypsum properties owned in the Warden district, British Columbia. A tunnel will be driven to determine the extent and uniformity of the beds, and if the results are satisfactory, an aerial tramway will be built to carry the raw gypsum over the Kootenay river to the railway, from which it will be transported to the plant at South Westminster, B. C.

Cement

San Antonio Portland Cement Co., San Antonio, Tex., are planning the erection of a new steel shed to cover the kilns at Cementville, Tex. The structure will be 1-story, 75x100 ft., of structural steel and sheet metal, to cost about $20,000. W. E. Simpson Co., National Bank of Commerce Bldg., San Antonio, are the engineers.

Universal Portland Cement Co. will begin the erection of an addition to replace the present stock house B at the Universal, Penn., mill which is to be dismantled. The new structure will cost about $250,000 with equipment.

Coplay Cement Co., Coplay, Penn., has started work on the expansion program which is to cost about $750,000. Additional grinding equipment, electrical apparatus and other machinery will be installed.

Atlas Portland Cement Co., New York, N. Y., is reported to have taken several options on land near their holdings at Saylorsville, Penn.

Cement Products

Loeb Stone Co., Memphis, Tenn., have just completed a new addition to their cast-stone plant.

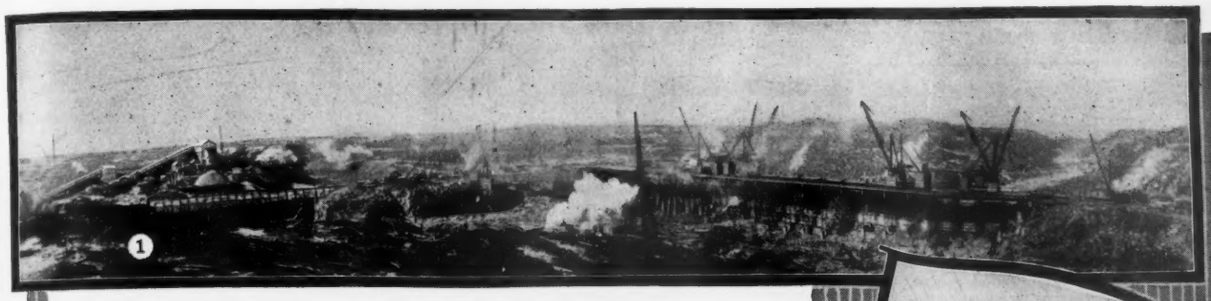
Shelton Concrete Co., Shelton, Wash., have recently installed a new tile machine and concrete mixer at their new plant. F. C. Willey and Harry Baker are the proprietors.

Wilson & Lyne, Russelville, Ky., have purchased additional cement products machinery which will be installed at their plant.

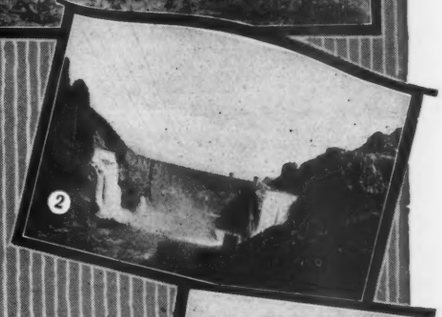
Venice Cement Products Co. has recently started operations at their new plant at Venice, Fla. The company has installed new power equipment, including a tamping machine and a batch mixer. O. W. McDonald is president.

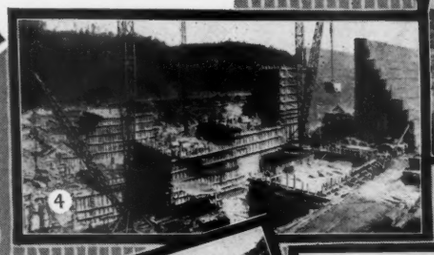
Henry Decorative Stone Co., Los Angeles, Calif., has purchased property at San Fernando Road and West Broadway, Glendale, on which a new factory will be erected.

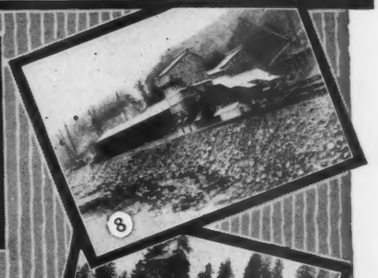
Swanson Building Units, Ltd., Sault Ste. Marie, Ont., have purchased the building block plant of McPhail & Wright on Bay Street. H. Appleton is president.

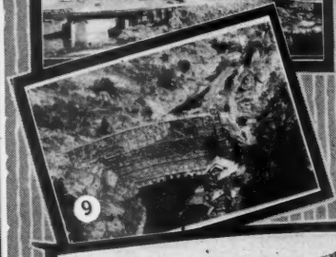


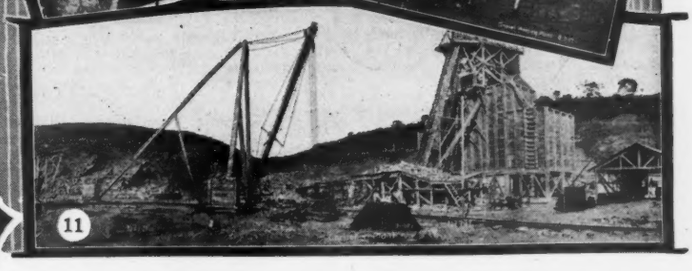
Some Notable Achievements of Engineering History











Large Dams, Irrigation Projects, etc.

In which Allis-Chalmers Engineering Service and Equipment have been Important Factors

1. Quebec Development Co., Isle Maligne Development. Complete rock crushing plant. Allis-Chalmers hydraulic turbines developing 540,000 H. P. are also being installed.
2. Roosevelt Dam, Elephant Butte, Arizona. Complete cement plant.
3. Ebro Dam, Barcelona, Spain. Crushing and cement plant.
4. Locks and Dam No. 17, Black Warrior River, Alabama, U. S. Government. Complete crushing plant.
5. Barberine Dam — Switzerland. Crushing, washing and screening plant.
6. Naval Dry Docks, Toulon, France. French Government. Crushing plant complete with motor drive.
7-8. Cheoah and Badin Dams and power plants, Yadkin River. Tallassee Power Co. In addition to the crushing plants used in construction, Allis-Chalmers hydro-electric units are installed in power plants.
9-10. Southern California Edison Co. Allis-Chalmers crushing equipment used in the construction of five large development projects as well as hydraulic and electrical machinery in several power plants.
11. Reservoir Dams, Government of Brazil. Rock crushing and cement grinding plants.

Arrow Rock Dam, near Boise, Idaho.
Panama Canal, Panama. Crushing plant at Colon.
Wilson Dam, Muscle Shoals, Tennessee River.
Lookout Shoals Development, near Catawba, N. C. Southern Power Co.
Tallulah Falls, Tallulah, Georgia. Georgia Railway and Power Co.
Goat Rock Development, Chattahoochee River, near Columbus, Ga. Columbus Power Co.

Let Allis-Chalmers Engineers Serve You.

ALLIS-CHALMERS

MILWAUKEE, WIS. U.S.A.

When writing advertisers, please mention ROCK PRODUCTS

Rock Phosphate

S. S. Tela arrived recently at Montreal, Can., with a cargo of 4484 tons of pebble phosphate, consigned to the Electric Reduction Co., Ltd., Buckingham, Que. This is the second cargo of phosphate rock for Montreal this season, one other having arrived in May.

Lime

Los Angeles Lime Co., Los Angeles, Cal., is about to begin the construction of a two-story, 111x158 ft., brick office and warehouse at 1732 East 15th Street, to cost about $14,000.

Sand-Lime Brick

Leaside Brick and Sand Co., Ltd., Leaside, Ont., is planning the erection of a plant to cost $70,000 to replace the one recently destroyed by fire.

Miscellaneous Rock Products

Blackrock Asphalt Co., Russellville, Ky., of which Edwin Lodge of Buffalo, N. Y., is president, plans extensive asphalt operations in Logan County, Ky.

Bath, Me. The new Brownsville quarry is expected to start shipments of slate to the Bath Iron Works within a short time.

Colbert Lime Rock Asphalt Co., Sheffield, Ala., is reported to have purchased 1800 acres of land near Sheffield at a price said to be about $250,000. The new tract on survey is said to show about 10,000,000 tons of rock asphalt. The company is to expand its operations and contemplates changes and additions in its management.

Personals

H. G. Steinbrenner has been elected second vice-president of the Brown Hoisting Machinery Co., Cleveland, Ohio, and will have charge of the marketing of the company's products.

Jean M. Allen, engineer, announces that he has severed his connection with the Reynolds Dredging Co., New Orleans, La., and has established offices at 2047 McCormick Bldg., 332 S. Michigan Ave., Chicago.

Louis K. Plosser, Jr., has been appointed secretary-treasurer of the Longview Lime Works and the Saginaw Lime and Stone Co., Saginaw, Ala., to succeed Miss Sarah Arnoll, who has resigned.

J. B. Ford, president of the Huron Portland Cement Co., sailed recently on the Gripsholm for an extended trip to Scandinavia and the Continent.

B. F. Affleck, president of the Universal Portland Cement Co., Chicago, was host to officials of the Lincoln Highway Association and about 20 other good roads advocates at a recent luncheon at the Union League Club, Chicago.

Obituaries

Frederick C. Peters, manager of the E. I. du Pont de Nemours & Co. New York office, one of the outstanding figures in the sales branch of the explosives industry, died recently in the Fifth Avenue Hospital, New York, after an illness dating from early in May. Mr. Peters' health had suffered a general breakdown and death was due to a complication of troubles rather than to any definite illness. He is survived by his wife, Margaret F. Peters.

Oliver Test, a pioneer in the cement products business of central Indiana, died recently at his home at Richmond, Ind. Mr. Test, who was 91 years of age, is said to have been the first products manufacturer in and about Richmond. He had built up a large and extensive business in this line.

Manufacturers

Link-Belt Co. held their chain drive conference recently at the Dodge works, Indianapolis, Ind. The conference was presided over by James I. Watson, general manager of the Dodge plant, and was attended by 50 sales representatives from all sections of the country. The principal features discussed were better methods of serving the respective fields and promotion of business.

Chain Belt Co., Milwaukee, Wisc., announces that D. B. Catton has been placed in charge of the company's Portland office to succeed A. C. Sullivan, who died recently. Mr. Catton will look after both the chain and conveyor business of the company, though the concrete mixers made by the same company will continue to be handled by the Loggers and Contractors Machinery Co.

Sullivan Machinery Co., Chicago, Ill., announce the removal of their Boston office to Suite 701, 45 Milk St.

Nordberg Mfg. Co., Milwaukee, Wis., have received an order for three Diesel engines, each of 2250 hp., from the Commerce Mining and Royalty Co., Miami, Okla.

Kuhlman Electric Co., Bay City, Mich., announces the establishment of a factory office at 3-260 General Motors Building, Detroit, Mich., with Richard P. Johnson in charge.

Harnischfeger Sales Corp., Milwaukee, Wisc., announces the appointment of H. S. Beale as sales engineer in the New York territory, with offices at 50 Church St., New York, and S. B. Bubier as sales engineer in charge of the Miami district work, offices at room 306, 343 S. W. River Drive, Miami, Fla., succeeding H. A. Wolcott, who has been made district manager of the New York territory.

Burke Electric Co., Erie, Penn., announce the appointment of Louis D. Moore, 1201 Syndicate Trust Building, St. Louis, Mo., and W. C. Fletcher Co., 725 Continental Bank Building, Indianapolis, Ind., as district sales agents in their respective territories.

Morse Chain Co., New York, N. Y., has appointed Maurice R. Hart manager of the new Buffalo office located in the Ellicott Square Bldg.

Charles C. Phelps, 473 Getty Ave., Paterson, N. J., announces that he and Charles J. Schmid, his associate, have been appointed Metropolitan New York and Northern New Jersey representatives for the Uehling Instrument Co. of Paterson, the Williams Gauge Co. of Pittsburgh, the Combustion Control Division of the A. W. Cash Co. of Decatur, Ill., and the National Boiler Productor Co. of Dayton, Ohio. Mr. Phelps still retains his former connection with the Uehling company as treasurer of that organization. Mr. Schmid was formerly the Boston representative of the Uehling Instrument Co.

Hyman-Michaels Co., Chicago, Ill., have purchased the Cleveland, Painesville and Eastern railroad and plan to dismantle it immediately and place on sale the rails, wire and rolling stock.

Stephens-Adamson Co., Aurora, Ill., celebrated its 25th anniversary recently by a dinner at the Aurora Country Club. Besides executives from the main plant at Aurora, Ill., and the branch plant at Los Angeles, Calif., there were present district managers and sales engineers from Boston, New York, Huntington, Pittsburgh, Detroit, St. Louis, Chicago and Los Angeles.

Pennsylvania Pump & Compressor Co., Easton, Penn., announces the appointment of Samuel Arnold, 3rd, Fulton Bldg., Pittsburgh, Penn., as their representative in the Pittsburgh district.

Climax Engineering Co., Clinton, Iowa, announce that the Underwriters' Laboratories, Chicago, have listed as approved for fire protection purposes Climax engine models **R4U** and **R6U**. These are said to be the first medium speed industrial engines to gain this approval for driving 750 and 1000 gal. pumps.

St. Louis Steel Products Co., Greenville, Ill., has changed its name to Coates Steel Products Co. There has been no change in personnel or business policy.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Electric Ventilation. Illustrated bulletin showing various installations of electric ventilating apparatus in different places. Contains typical layouts of installations and brief description of ventilators. 32 pp. AMERICAN BLOWER CO., Detroit, Mich.

Orton Flexible Tread Cranes. Bulletin No. 41 describing and illustrating Models T and E convertible cranes with attachments. General data and specifications, etc. ORTON CRANE AND SHOVEL CO., Chicago, Ill.

Insulating Materials. Pamphlet on Sil-O-Cel C-3 and Sil-O-Cel C-3 concrete, giving the physical properties, specifications and uses of these materials for various types of equipment, etc. CELITE PRODUCTS CO., Los Angeles, Calif.

Crushing Rolls. Bulletin No. 1107 on Traylor four-tension rod type crushing rolls. Illustrations and details of construction, capacity, etc. 24 pp. TRAYLOR ENGINEERING AND MFG. CO., Allentown, Pa.

Air Lift Pumping Methods and Equipment. Bulletin No. 71-S describing air lift pumping installations in various industries. Layouts, designs, tables and charts o performance and it struction for securing well data and estimates on air lift pumping, etc. 45 pp., 6x9 in. SULLIVAN MACHINERY CO., Chicago, Ill.

Keystone System of Grease Lubrication. Bulletin on the use and application and lubricants and lubrication systems in various industries and equipment. Diagrams on installation, data on lubricants, costs, etc. KEYSTONE LUBRICATING CO., Philadelphia, Penn.

Slackline Cableway Excavators. Catalog No. 9, describing and illustrating Sauerman cableway excavators for moving materials from 200 to 1200 ft. Details on operation methods, capacities, equipment and typical layouts for efficient operation of sand and gravel plants, etc. 8½ x 10¾ in. SAUERMAN BROS., INC., Chicago, Ill.

Electric Traveling Cranes and Hoists. Catalog No. 100, illustrating and describing Milwaukee equipment and electric cranes and hoists. Data on design, construction, lubrication and specifications. 52 pp., 8½ x 11 in. MILWAUKEE ELECTRIC CRANE AND MANUFACTURING CO., Milwaukee, Wis.

Rebuilt Rolling Stock. July bulletin on rebuilt locomotives, steel rails, dump cars, shovels, etc., offered for sale by SOUTHERN IRON AND EQUIPMENT CO., Atlanta, Ga.

Lunkenheimer Valves and Equipment. Illustrated catalog showing various types of valves, boiler mountings, gauges, etc., for different uses. Details of design, construction and data of uses. 16 pp., 8½x11 in. THE LUNKENHEIMER CO., Cincinnati, Ohio.

Blaster's Scale. Convenient and useful scale for blasting operations using well-drilled holes. HERCULES POWDER CO., Wilmington, Del.

Kennedy Products. General catalog describing and illustrating complete line of rock products machinery and equipment built by the KENNEDY-VAN SAUN MFG. AND ENG. CORP., New York, N. Y.

Diesel Engine. Catalog No. 34, describing and illustrating type "KD" Diesel engine of 50 to 360-hp., made by ANDERSON ENGINE AND FOUNDRY CO., Anderson, Ind.

Loading Machines. Catalog No. 45 on the Mayne loader for use in underground mines. Illustrations, description of operation, details of design, specifications, etc. WEBSTER MFG. CO., Chicago, Ill.

Speed Reduction Units. Catalog on speed reducers in general, including figures, charts and illustration on the four types of units produced by the PHILADELPHIA GEAR WORKS, Philadelphia, Pa.

Telsmith Publications. Bulletin No. 261D on primary breakers and reduction crushers; **262A** on mounted gyratory breakers, portable bins, etc.; **264A** on jaw crushers, portable and stationary; **267A** on quarry plant layouts; **268A** on gravel plant layouts, and **266C** on screens, washers, conveyors, elevators, bin gates, etc. All bulletins completely illustrated with details on design and data on various types of equipment, etc. SMITH ENGINEERING WORKS, Milwaukee, Wisc.

Cement and Lime Packers. Bulletin illustrating and describing Bates systems for filling and closing bags. Illustrates types of packing machines of various capacities and designs to be used with different materials. BATES VALVE BAG CO., Chicago, Ill.

Lorain 75. Bulletin describing and illustrating this model. THEW SHOVEL CO., Lorain, Ohio.

Coal and Ash Handling Methods. Bulletin No. 429 describing 8 efficient methods and equipment for handling coal and ash in the power plant. Illustrations, details on equipment type and design, etc. JEFFREY MFG. CO., Columbus, Ohio.

Economy of Diesel Engine Power. Bulletin No. 1010, containing an analysis of the various factors which affect the cost of power, such as fuel cost, operating labor, maintenance, first cost and fixed charges, reliability and simplicity. The costs of a typical small Diesel power plant are analyzed and compared with similar costs for a steam plant. Other interesting chapters cover such points as the cost of purchased power, layout of the Diesel plant, and the question of the fuel oil supply. Discussion of the application of Diesels in a wide variety of industries together with illustrations of Diesel equipped plants. FAIRBANKS, MORSE & CO., Chicago, Ill.

Large Diesel Engines and Their Lubrication. A very interesting and comprehensive discussion on the Diesel engine and current methods of lubrication and types of lubricant necessary. **Lubrication**, June, 1926. THE TEXAS CO., New York.

Ruggles-Coles Dryers. Catalog No. 16A, describing and illustrating dryers for different rock products. Interesting and useful data on drying capacities, tables, etc. HARDINGE CO., INC., York, Penn.